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NOTES AND COMMENTS.

The New Canadian Tariff.

The Ottawa correspondent of *The Times*, in an interesting article on the new Canadian tariff draws attention to the section devoted to sugar, and its effect on the West Indies and British Guiana. The preferential rate on raw sugar is increased by 7½ cents, or to 34 c. per 100 lbs., the middle rate to 45 cents, and the general rate to 52 cents per 100 lbs. With respect to these three-fold rates, it may here be explained that "the tariff is made up of three separate schedules—(1) the British preferential tariff; (2) an intermediate tariff; and (3) the general tariff. The first named applies as at present to Great Britain and those British colonies which already enjoy that benefit. The intermediate tariff is not brought into force at once, but is held for purposes of negotiation with foreign countries who may be desirous of trading with Canada on a fair basis. The Government's intention is to hold it as a standing offer to all foreign countries willing to make reciprocal tariff arrangements with the Dominion, by which means it is hoped largely to increase Canadian markets abroad. The general tariff applies to all foreign countries and to those portions of the British Empire which have declined hitherto to trade with the Dominion on a reciprocal basis." There is moreover an additional schedule or two, of which one is a surtax which applies only to German imports, and amounts to one-third more than the

duty specified in the general tariff. This surtax as already enforced has resulted in the absolute crowding out of all German sugar.

To further quote *The Times*, last year Canada imported 390,846,220 lb. of raw sugar, valued at $8,121,935. Of this quantity 344,366,430 lb. came in under the preference from the following countries:—British Africa, 5,591,845 lb.; British Guiana, 105,242,994 lb.; British East Indies, 430,253 lb.; British West Indies, 218,345,718 lb.; Fiji Islands, 14,755,620 lb. On the basis of last year's importations from the sister colonies enjoying the benefit of the preference the increase on the sugar duties of 7⅓ cents per 100 lb. means an addition to the revenue of the Dominion of $252,524, indeed Mr. Fielding (the Finance Minister) placed the figures at $300,000. The sugar crop in the West Indies has been gathered. In British Guiana the sugar making season is in progress. As a rule the West Indian crop is bought by the Canadian refineries for future delivery, so that the Canadian importer will at once feel the effect of the increased duty. On the other hand, where a planter, say, in British Guiana, has not sold his crop, he will promptly be met with the offer of a lower price by the Canadian buyer, in order to meet the tariff increase, and, of course, will be the sufferer.

Queensland Sugar Mills.

On another page we give some further details of the working of the Queensland Government sugar mills, including a brief summary of their profit and loss accounts. From this latter it will be seen that since the Government took possession of the defaulting concerns, debit balances have, in the case of four out of the six mills mentioned, been wiped off and substantial credit balances substituted. These results, arising as they undoubtedly do from efficient reform and careful management, are a matter for congratulation to Dr. Maxwell and his staff. Of the two exceptions, one (Mount Bauple) shows a satisfactory improvement, while Nerang River appears to have suffered unduly from adverse conditions, chief among which may be cited the frosting of practically all the cane. The vexed question of white *v.* coloured labour is not, however, touched on in Dr. Maxwell's report and we are left to conjecture what will be the result of the present wholesale deportation of Kanaka labourers on next year's balance sheets.

The Sugar Industry in India.

Some attention has been given in the press of late to the room for improvements needed in the cane sugar industry of India. Mr. H. V. Raw, Deputy-Superintendent of Statistics of Madras, recently read a paper on "The Problems of the Sugar Industry in India." He pointed out that whereas at present India, under the most

primitive methods, turns out annually three million tons of cane sugar, or 39 per cent. of the world's supply, she could easily produce half as much again at a reduced cost if the available area for cultivation were all made use of, and modern methods were established. At present serious drawbacks exist. Lack of organization, of central factories, and of cheap and expeditious carriage on the one hand; ignorance of the native cultivator and native capitalist on the other, all contribute to the present unsatisfactory state of affairs. Semi-skilled labour seems indispensable, and to get this, Mr. Raw suggests that the returning emigrants from the sugar estates in the West Indies should be collected and employed on sugar estates at home. But we think that their knowledge will be at the most purely superficial, and that unless properly trained overseers are to be got, success will be only spasmodic.

What we think India wants is a "School for Sugar Industry," something after the style of those to be found abroad, only less advanced. There are, undoubtedly, scores of Indian gentlemen with some available capital who are disposed to embark on the business of sugar making, but knowing nothing of modern systems and the working of modern plant. Some of them are sanguine enough to suppose that the needed information can be gleaned in the course of a few correspondence lessons, preferably supplied gratis. It seems a pity that when the *will* is present, the *way* should be so beset with difficulties. Could it be found possible for the Indian Government to form a sugar school, conducted by practical and experienced men, and to give to the educated natives a course of instruction such as should enable them to start with success the manufacture of good grade sugars, something might be done towards solving the problem. Indians are quite capable of receiving advanced education, and would surely welcome the foundation in their midst of a Government agricultural college. We commend this suggestion to the attention of the Indian Department of Agriculture, and would remind them that Germany, the most scientifically trained of all the sugar producing countries, has long had sugar schools, such as the one at Braunschweig, presided over by Drs. Frühling and Rossing (whose annual prospectus will be found elsewhere in our advertising columns), which enters now on its 36th year of study.

The West Indian Agricultural Conference, 1907.

We glean from our West Indian exchanges that the Agricultural Conference is this year to be held in Jamaica between the 11th and 17th of the present month. It will be remembered that last year's attempt to hold the Conference in that island was a failure owing to the inability of the steamship companies to provide convenient service connexions. This time, however, thanks to the co-operation of

Messrs. Elder, Dempster & Co., of the Imperial Direct West India Mail Service, passengers from British Guiana and neighbouring colonies will be picked up at Barbados and taken direct to Jamaica. The return journey will be similarly performed on the 17th and subsequent days. As the chief drawback seems now removed, one can hope that the Conference will be an entire success. Jamaica seems to be returning somewhat to her old love, the cultivation of sugar, as the recent planning of new central factories shows; and the presence in her midst of so many sugar men from all over central America should prove a stimulus to her. Mention of the travelling arrangements suggests to our mind that in the mind of those who have not personally visited this island colony, her supposed juxtaposition to the other colonies, such as Barbados, Trinidad, and Demerara, is mostly very wide of the mark. A cursory inspection of a map will greatly enlighten most of us, and when we learn that Jamaica is not much less than 1200 miles from Barbados, we realize somewhat more clearly the drawbacks of distance from which our West Indian colonists suffer.

The Closing of a Liverpool Refinery.

We much regret that the well-known Liverpool firm of sugar refiners, Messrs. Crosfields Ltd., have got into difficulties and that their refinery in Vauxhall Road is being disposed of with all its stock-in-trade. An advertisement of the sale, it will have been noticed, appeared in our last number. The cause of the failure was not, however, due to ruinously low prices such as stopped many a refinery in the old days of bountied sugar, but was caused by business speculations, wherein large stocks of sugar were held too long. This unfortunate affair is greatly to be deplored, all the more just now when British refining has taken a new lease of life and the exports of British refined sugar for the 12 months ending December 31st, are, to all appearances, exceeding those of any of the past nine years, and should amount to 900,000 cwts. or more. But we have to go back to 1894 to find a total of over 1,000,000 cwts. of exported British refined. Can we count on a similar total by the end of this year? If the rate of increase continues till then, it should be more than possible. At any rate our refiners may be counted on to do their best.

Commission for Uniform Methods of Sugar Analysis.

In our October issue we gave a short resumé, after F. Sachs in the *Sucrerie Belge*, of the proceedings at the Fifth Meeting of the International Commission for Uniform Methods of Sugar Analysis, held in Bern last August. We are now able to give the full official report of the sittings as prepared by the Secretary, Dr. Wiechmann, and this will be found on another page.

FIFTH MEETING OF THE INTERNATIONAL COMMISSION FOR UNIFORM METHODS OF SUGAR ANALYSIS.

August 3rd and 4th, 1906, in the University of Berne.

On the 3rd of August there were present Messrs. :—

Professor Dr. A. Herzfeld, as Chairman, Delegate of the *Verein der Deutschen Zucker-Industrie.*

Furthermore, from Germany:

Geheimrat Professor Dr. von Buchka, Delegate of the Imperial Treasury in Berlin;

Professor Dr. Brodhun, Delegate of the *Physikalisch-technische Reichsanstalt* in Berlin;

Regierungsrat Dr. Plato, Delegate of the *Normal-Eichungs-Kommission* in Berlin;

Dr. B. Hermann, i.Fa. Alberti & Hempel, Chemist in Hamburg;

Dr. W. Raatz, i.Fa. Zuckerfabrik Klein-Wanzleben.

United States of America:

Dr. F. G. Wiechmann, Representative of the American Sugar Refining Company, New York.

Belgium:

Dr. Fr. Sachs, Brussels, Representative of the *Société Générale des Fabricants de Sucre de Belgique.*

England:

Alexander Watt, Delegate of the Sugar Association of Lancashire, Liverpool;

Hugh Main, Delegate of Henry Tate & Sons, Ld., London;

D. S. Macdonald, Delegate of Henry Tate & Sons, Ld., Liverpool.

France:

E. Saillard, Delegate of the *Syndicat des Fabricants de Sucre de France*, Paris;

François Dupont, Delegate of the *Association des Chimistes de Sucrerie et de Distillerie de France et des Colonies*, Paris;

H. Pellet, Paris.

Holland (Java):

H. C. Prinsen Geerligs, Delegate of the Syndicate of Java Sugar Manufacturers, Pekalongan.

Austria-Hungary:

Regierungsrat F. Strohmer, Delegate of the *Centralverein für Rübenzucker-Industrie in der öster.-ungar. Monarchie*, Vienna;

Dr. Nevolé, Delegate of the *Verein der Zuckerindustrie in Böhmen*, Prague.

Russia:

Professor Iwan Schukow, Delegate of the Russian Imperial Treasury, Kiew, and of the Association of Russian Sugar Manufacturers.

Switzerland:

Dr. P. Liechti, Director of the Swiss Agricultural Institute, Bern;
Dr. Schaffer, Professor in the University of Bern, Chemist to the Canton;
Dr. A. Heffter, Professor in the University of Bern;
Otto Lehmann, Manager of the Sugar Factory at Aarberg;
Möhring, cand. cam., Bern;
Ebenhusen, Bern.

Besides these there were present only on August 4th, Messrs.:—
Gustav von Dippe, Quedlinburg;
Carle Esche, i.Fa. Gebr. Dippe, Quedlinburg;
Dr. H. C. Müller, Director of the Experiment Station Halle a.S.;
Léon Boussaud, Assistant Director of the *Station d'essais de semences*, Paris;
Marcus Deutsch, Paris;
Ph. de Vilmorin, i.Fa. Vilmorin Andrieux & Co., Paris.

MORNING SESSION OF AUGUST 3RD.

The Chairman opened the session with several announcements, reading a cable from Wilson, Secretary of Agriculture, United States of America, stating that the States' chemist, Wiley of Washington, was prevented from coming to Bern; he also read an address of welcome from the Department of Commerce of the Swiss Government. He stated that a stenographer was present who would take down communications made in the German language.

Then the Chairman (Item I. of the Day's Proceedings) gave a review of the achievements of the Commission founded in 1897. He designated the duties of the Commission to be purely analytical. The Commission has for its object the regulation of the methods of sugar analysis, and endeavours to secure the working of chemists according to uniform and the best methods, but the Commission does not undertake to establish trade customs. The Commission does not recognize resolutions carried by majority vote, it is in fact necessary that at least the representatives of the most important countries interested in sugar be in accord on a question, before the same is presented for acceptance, as otherwise no reliance can be placed on the recognition of the resolutions by chemists.

No. 2 of the Day's Proceedings.

DETERMINATION OF A METHOD OF PREPARING FEHLING'S SOLUTION AS WELL AS THE MANNER OF MAKING INVERT SUGAR DETERMINATIONS.

Messrs. Watt and Wiechmann communicated the results of their investigations. Their writings will be published in the technical journals. Mr. Watt preferred the volumetric method, Dr. Wiechmann the gravimetric method for commercial analyses. *The latter moved that clarification with basic lead acetate shall be obligatory for the*

examination of syrups. This recommendation was endorsed by Messrs. Watt and Prinsen Geerligs, and thereupon also by the entire Commission.

The Chairman reported on tests made for the comparison of Violett's and Fehling's solution, which had not yet been completed. He announced that Mr. Munson, the Chairman of the Association of American Agricultural Chemists, had, through the intervention of Dr. Wiechmann, sent him a resolution of the association named, wherein the same expressed the wish to work hand in hand with our Commission in the matter of securing a uniform alkaline copper solution.

Mr. Pellet also presented a paper on this subject which is published in the *Sucrerie Indigène* as well as in the *Deutsche Vereinszeitschrift* and the *International Sugar Journal.* Mr. Strohmer promised a later report of his experiments bearing on this question which at present is not yet completed. He recommended to retain for the present the so-called Herzfeld's Method.

Mr. Watt declared himself against basic lead-acetate clarification for solid sugars.

Mr. Sachs refrained from voting.

Mr. Saillard, as well as Mr. Dupont, expressed themselves in favour of retaining basic lead-acetate clarification as long as the present method is used.

Mr. Pellet declared himself against the use of basic lead-acetate as a clarifying reagent.

Mr. Schukow favoured this clarification in commercial analysis.

Mr. Watt handed in the following declaration:—

> "The difference between the amount of the reducing substances in the clarified and the non-clarified solution of beet sugar lies so closely within the limits of the errors of observation, that a clarification is unnecessary; but in products which contain a large amount of glucose, a clarification is of great importance."

Mr. Herzfeld was of the opinion that he could not accept the first half of the declaration; the difference was indeed a small one, but gave rise to considerable annoyance in trade.

Mr. von Buchka proposed to defer the question of the composition of Fehling's solution, and to have the same studied further by a separate commission.

Mr. Geerligs expressed himself in favour of the basic lead-acetate clarification for syrups.

Mr. Main spoke against the basic lead-acetate clarification in raw sugars.

The Chairman proposed to request the chemists of Great Britain to discuss this question in a separate conference once more with delegates of the Commission in order to try, in this manner, to bring about an agreement.

The proposition of the Chairman was accepted by the Commission, and a sub-commission was appointed consisting of Messrs. Strohmer, Saillard, Sachs, Schukow, van Ekenstein, Watt, Main, von Buchka, and Herzfeld, which sub-commission was to take part in the conference with the chemists of Great Britain.

The Chairman agreed to ask for the intervention of the German Export Societies, to the end that the conference might soon be called in London.

The question of Fehling's solution will be subjected to further study.

No. 3 of the Day's Proceedings.

UNIFORM INTERNATIONAL DIRECTIONS FOR THE SAMPLING OF SUGAR PRODUCTS.

The report of this topic was presented by Dr. Wiechmann, and is published in the *Zeitschrift des Vereins der Deutschen Zucker-Industrie* as well as in *The International Sugar Journal.** He advocated sampling every package as it is also customary in England.

Dr. Hermann, as well as Mr. Strohmer, declared themselves against the regulation of this question by the Commission.

Dr. Wiechmann remarked that a 100% sampling had been customary in his country for years, and that it was done also in the refinery with which he was connected. The address of Dr. Wiechmann was, after printing, to be recommended for consideration to the parties concerned.

No. 4 of the Day's Proceedings.

RESOLUTION CONCERNING A UNIFORM FORM AND MANNER OF EXPRESSION OF CERTIFICATES OF ANALYSIS FOR THE INTERNATIONAL SUGAR TRADE.

The Referee, Mr. Saillard, presented a collection of certificates of analysis of different countries. Mr. Saillard presented the following resolutions :—

1. As long as it is not settled that the degree of alkalinity is a sure criterion for the keeping qualities of sugars, the determination of alkalinity shall not be considered in international commerce.

2. The Commission shall determine upon a uniform method by which the trade yield (*rendement*) for the sugar is to be calculated, in establishing scientific molasses co-efficients for the impurities (ash and invert sugar) the relation of which is used in the certificates of analysis.

3. The state laboratories shall also take part in the endeavours to bring about uniformity, in order to cause a disappearance of the differences between trade ash determinations and Regie ash determinations. (France.)

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* See page 18.

The Commission did not take action upon resolutions 1 and 2, but the Commission agreed to resolution 3 after the same had been spoken for by Mr. H. Pellet.

A discussion of some length was held on the use of postal cards for the purpose of certificates of analysis. Mr. Strohmer declared himself against this custom as the certificate is an official document, and as such should be endowed with a certain degree of privacy.

Dr. Hermann suggested to determine in a general way which data shall be mentioned in the certificates, and whether heavy or light paper should be used. He declared himself against the use of postal cards.

Mr. Sachs declared that the postal cards must be retained in Belgium because they show when the analyses are sent off.

The Commission decided for the present not to endorse any specific form of certificate of analysis. It was resolved to publish the report of Mr. Saillard in full and to send this report to the mercantile corporations of the different countries.

AFTERNOON SESSION, FRIDAY, AUGUST 3RD.

No. 5 of the Day's Proceedings.

AVOIDANCE OF THE PRECIPITATE ERROR IN OPTICAL SUGAR ANALYSIS.

In his extensive report, which is published in the *Deutsche Vereinszeitschrift*, Dr. Wiechmann recommended Horne's dry clarification.

Mr. Pellet in his report, which is also published, expressed himself against this method. He recommended the general application of Clerget's method.

The Commission resolved to have the reports printed and then to submit the matter to further study.

No. 6 of the Day's Proceedings.

SUGGESTIONS FOR THE PREPARATION OF UNCHANGEABLE COLOUR STANDARDS IN PLACE OF THE RAW SUGAR USED FOR THE DUTCH STANDARDS.

Dr. Herzfeld made a report on experiments made to substitute samples of coloured glasses for the Dutch standards, which experiments he had made at the recommendation of Messrs. F. O. Licht, Magdeberg, and Fraser & Co., Rotterdam.

A comparison of samples, which were kept for months in sunlight or in darkness, showed that the crushed glass samples had not suffered change in the light; nevertheless, the speaker did not believe that he could endorse the method, because it was fundamentally wrong to determine the colour of sugar except in solution.

Mr. Strohmer emphasized that at least two colour types would have to be taken, one for beet sugars and one for colonial sugars. The colour of the sugar was dependent upon the formation of the crystals.

The assembly thereupon unanimously expressed the wish that the valuation of sugar according to its colour might soon be abandoned altogether, because it was to be condemned from a scientific as well as from a practical standpoint.

No. 7 of the Day's Proceedings.

RESOLUTION CONCERNING A METHOD TO BE RECOMMENDED FOR THE DETERMINATION OF THE SUGAR-CONTENT OF BEETS.

The reports of Messrs. Pellet and Sachs are printed in the *Verein Zeitschrift*, and of Mr. Pellet alone in the *International Sugar Journal*.

Mr. Herles, in Prague, had addressed to the Chairman a communication, dated August 1st, concerning questions of priority, the content of which was communicated.

The Commission unanimously adopted the following resolution: "The Commission is of the opinion that the aqueous digestion method for the determination of the sugar-content of the beets, if it is executed with due regard to the precautions suggested by Sachs, Pellet, and others, is more to be recommended in practice with the sugar industry than the alcohol method. The Commission charges Messrs. Pellet, Sachs, and Herles to present detailed working directions of the method."

Thereupon,

No. 9 of the Day's Proceedings,

MAKING THE SACCHARIMETRIC NORMAL WEIGHT UNIFORM,

was discussed.

The Chairman first of all read a resolution bearing on this subject adopted by Section 5 of the Rome Congress, and remarked that the resolutions of that Congress had been communicated to him not only by the governing body of that Congress but also by the Verein Deutscher Zuckertechniker, with the expression of the wish that the Commission should place itself on record with respect to the same.

Concerning the normal weight, the Commission in 1898 at the Vienna Session, according to the Proceedings, took the following action: "Concerning the latter point, all those present declared their willingness to work in their home countries for the future adoption of the normal weight of 20 grams."

In the Proceedings of the Paris Conference, 1900, on the other hand, the following passage occurs: "Mr. François Sachs, as well as Mr. Strohmer, raised objections against the general normal weight 20·00. In consequence it was decided not to attempt the general introduction of this weight, but the following resolution was adopted: 'It is desirable that a uniform normal weight be introduced for general international use.'"

The report of Mr. Dupont culminated in the proposition to introduce the normal weight of 20 grams. The address is printed in the *Verein Zeitschrift*.

Mr. Dupont proposed the following resolution: "The Commission expresses the desire that the actually existing saccharimetric normal weights be replaced by a single one of the weight of 20 grams; that dating from the Seventh International Congress for Applied Chemistry the new weight should be used exclusively in trade and customs analysis of sugars: that in the present year the International Commission, together with the Commission for Uniform Methods of Sugar Analysis, study the conditions of graduation, the testing and the application of the new weight, and make a report which be published in the Report of the Rome Congress: that this Commission be also directed to prepare saccharimetric tables and corresponding density tables."

In the debate which followed the Chairman once more referred to the resolutions of the Rome Congress. With the approval of a large majority of the delegates he stated that the resolutions of this Congress would hardly have any practical sequences: that, however, the same it appears should in part not remain without contradiction. Thus, for instance, it appeared to him to be regretted that in the last resolution the governments were requested to regulate the methods of the customs sugar control of the different countries uniformly, without, at the same time, applying for the assistance of the independent chemists and of the associations of manufacturers.

The majority of sugar chemists were also not in a position to approve of the resolution concerning litmus and phenolphthalein alkalinity.

He thereupon addressed the question to those present, whether any one desired the retaining of the German normal weight of 26 grams?

Mr. Sachs answered in the affirmative.

Mr. Saillard did not consider it necessary that all countries should have the same normal weight in order to have a uniform method.

On the question being put by the Chairman, the representatives present of America, Java, Great Britain, Russia, and Austria-Hungary, declared themselves against the normal weight of 20 grams and for the normal weight of 26 grams.

Mr. Sachs declared himself in accord with Mr. Salliard to admit 26 grams, but not to prescribe it.

The Chairman was charged with expressing to Mr. Villavecchia, Rome, the wish of the Commission, that the members of the International Commission for Uniform Methods of Sugar Analysis be invited to participate in the conferences—should such be held—of the Government officials regarding methods for the customs-control of sugar.

SESSION, SATURDAY, AUGUST 3RD.

No. 8 of the Day's Proceedings.

CONFERENCE REGARDING MEASURES TO SECURE AN INTERNATIONALLY VALID UNIFORM METHOD OF BEET SEED VALUATION.

Mr. Strohmer delivered the report. The same in the first place spoke with regard to the result of the question-circular which he had addressed to all countries engaged in beet culture, and, basing thereon, made definite propositions to regulate the question.

On the recommendations of the Chairman first of all the proposition was accepted that the Commission should not occupy itself with the establishment of standards (Normen), but only with the establishment of methods of investigation.

Hereupon a sub-commission was elected which was to work out uniform methods of examination. Mr. F. Strohmer was appointed chairman of the same. He was charged with convening the sub-commission in question at the 8th International Agricultural Congress in Vienna in the year 1907, in order to take definite resolutions. The following were elected members of the sub-commission: Messrs. Strohmer (President), Saillard, Boussaud, Paris; Sachs, Schukew, Müller, Halle, Krüger, Berburg, Herzfeld, Raatz, von Dippe, Heine, Briem, Neumann, and Herles. The Commission was authorized to increase its numbers by the election of further members.

Thereupon Mr. Boussaud read a report on this subject, and Mr. Pellet did likewise.

On the motion of Mr. Nevolé no discussion was held.

Finally, those present agreed with the suggestion of Dr. Wiechmann that the previous proceedings of the meetings of the Commission be printed as a whole and be sent to the members. In case the expenses should be very considerable, the Chairman should request the corporate bodies interested in the Commission to bear their share of them. Up to this time all printing and other expenses have been borne exclusively by the Verein der Deutschen Zucker-Industrie.

On the motion of Mr. Sachs, the Commission expressed its thanks to their Chairman, Professor Dr. Herzfeld, for the direction of the debates.

F. G. WIECHMANN.

The shipments of centrifugal sugar from Martinique amounted in 1905 to 30,067 tons, valued at £466,101, being an increase of 6132 tons in quantity and £181,778 in value as compared with the shipments made in 1904.

ON THE EFFECT OF THE VOLUME OF THE LEAD PRECIPITATE IN CANE SUGAR ANALYSIS.

By Noël Deerr.

Ever since the introduction of the polariscope and clarification with basic lead acetate into sugar analysis, the volume occupied by the lead precipitate and its effect on the polariscope reading has been a source of many contradictory statements.

The majority of text books dealing with sugar analysis take it for granted that the lead precipitate affects the polariscope indication in proportion to its volume, and quote the well known methods of Sachs and of Scheibler for its determination.

There have not been wanting those who deny that the lead precipitate affects the polarization in an appreciable degree.

Sachs and de Barbieri* attribute the apparent absence of effect to the formation of potassium acetate which diminishes the specific rotation of cane sugar. H. Pellet† in particular claims that "the lead precipitate absorbs and carries down a certain quantity of sugar, thus neutralizing the error caused by the volume of the precipitate." The analysis he gives show that solutions of beet molasses and of beet sugars when made up to different volumes in the presence of their precipitates tend to give nearly identical polarizations and that the more dilute solution tends to give the higher polarization. L. Pellet when washing the precipitate free from sugar found similar results.

The following are the experiments that I have made upon the subject:—

To 100 cc. of a juice or solution of molasses 10 cc. of basic acetate of lead were added, the material filtered and the polariscope indication observed; 100 cc. of the same juice or solution of molasses were made up to 440 cc. with the addition of 10 cc. of lead solution, then filtered and the polariscope reading observed. A series of observations is given below:—

	100 cc. — 110 cc. read in 10 cm. tube.	100 cc. — 440 cc. read in 40 cm. tube.
Juice	27·8	27·7
	25·2	25·2
	27·6	27·7
Molasses	26·7	26·7
	21·2	21·0
	17·0	16·9

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* Revue universelle de la Fabrication de Sucre, I. 451.

† International Congress of Applied Chemistry, Rome, 1906. *International Sugar Journal*, No. 93.

The results are not dissimilar to those obtained by H. Pellet, but as regards their bearing on the influence of the lead precipitate they demand that the specific rotation of a juice or molasses be independent of the concentration. To test this point 100 cc. of the clear filtrate of a juice or molasses were diluted to 400 cc. and readings of the undiluted and diluted material taken in the 10 cm. and 40 cm. tube respectively.

A series of observations gave results as under:—

	Undiluted read in 10 cm. tube.		Diluted 1 — 4 read in 40 cm. tube.
Juice	27·0	....	27·2
	26·8	....	27·1
	24·5	....	24·7
Molasses	16·5	....	16·9
	16·5	....	17·0
	22·8	....	23·2

These results lead to the conclusion that the specific rotation of cane products increases on dilution and account for the apparent absence of effect of the volume of the lead precipitate.

The following determinations were then made: 100 cc. of juice or of a solution of molasses were diluted with the addition of 10 cc. of basic acetate of lead to 110 cc., 220 cc., 440 cc., 660 cc.; and after filtration observed in the 10 cm., 20 cm., 40 cm., 60 cm. tubes; 100 cc. of the filtrate from the portion diluted in the ratio 100: 110 were diluted to 200 cc., 400 cc., 600 cc., and readings taken in the 20 cm., 40 cm., and 60 cm. tubes. The results are as below:—

		Juice.		Molasses.
a.	100 — 110	26·73	....	13·64
b.	100 — 220..	26·74	...	13·67
c.	100 — 440	26·71	....	13·69
d.	100 — 660..	26·80	....	13·72
e.	Filtrate from *a*, 1 : 2..	26·93	....	13·88
f.	,, ,, ,, 1 : 4..	27·00	....	14·00
g.	,, ,, ,, 1 : 6..	27·16	....	14·08

The result entered is the mean of ten readings in each case. In the case of the juice combining results *b* and *e*, *c* and *f*, *d* and *g*, the volume of the lead precipitate is found to be 1·54 cc., 1·56 cc., and 1·74 cc. per 100 cc. of juice. With molasses, as above, the volume of the lead precipitate is found to be 3·28 cc., 3·22 cc., and 3·36 cc. per 100 cc. of solution of molasses.

In the last-mentioned experiment the solution of molasses was of density 19·5° Brix.

The lead precipitate from 100 cc. of the juice and molasses was collected, washed, dried, weighed, and its specific gravity determined.

From the determination the volume of the lead precipitate was found to be 1·25 cc. per 100 cc. of juice, and 2·16 cc. per 100 cc. of molasses solution. The determinations do not agree with those calculated above, but, as Pellet has pointed out, we are not certain that the precipitate after drying will occupy the same volume that it does when formed in the sugar solution.

That there is no reason for supposing that a solution of a cane product possesses a specific rotation independent of its concentration, the already published determinations of sugar, dextrose, and levulose are sufficient to show.

Schmitz* found a continuous increase in the specific rotation of cane sugar with increasing dilution, his results being expressed in the formula:

$$[\alpha]_D^{20} = 66{\cdot}510 + 0{\cdot}004504\,p - 0{\cdot}0002805\,p^2,$$

p being the percentage of sugar in solution.

Tollens* obtained the formula:

$$[\alpha]_D^{20} = 66{\cdot}386 + 0{\cdot}015035\,p - 0{\cdot}0003986\,p^2.$$

In very dilute solutions Pribram* found a fall in the specific rotation with increasing dilution, but Nasini and Villavechia* obtained the opposite result. Dextrose, according to Tollens, shows a fall in specific rotation with increasing dilution. The specific rotation of levulose also falls on dilution, but this will tend to make the right-handed rotation of a cane product increase with dilution.

The conclusions that this series of observations lead me to are:—

1. Solutions of cane products when made up to different volumes in the presence of the lead precipitate tend to give nearly identical polarizations, when the readings are made at different concentrations.

2. This effect is due to the compensating effect of the volume occupied by the lead precipitate and the increase in specific rotation with dilution.

3. The lead precipitate has an effect on the polarization, and neglect of this tends to give a plus error to observations made under the conventional method of analysis.

All flasks used in the above experiments were carefully calibrated.

The Permanent Commission met at Brussels from December 10th to 12th. M. Capelle, head of the Department of Commerce and Consulates in the Belgian Ministry for Foreign Affairs, was elected President. No changes in the existing decisions were, however, made except as regards Roumania, the countervailing duty of which was reduced.

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* Quoted in Landholt's "Optical Rotation of Organic Substances." English edition of 1902, pp. 194, *et seq.*

PARITY OF 88 ANALYSIS BEET AND 96 POLARIZATION CANE SUGAR, DUTY PAID, AND CUBAN SUGAR, COST AND FREIGHT.

(From Willett & Gray's Circular.)

Without Bounty or Countervailing Duty.
Exchange at $4·88 per £.

Beet at 9s. per cwt. (112 pounds) f.o.b. Hamburg, add 4½d. for freight and lighterage to refinery—say 9s. 4½d. net per cwt. c. and f. to New York	2·044c.
Insurance—Bk. Comm.—Loss Weight—together 1½%........	·031
Duty (88 analysis outturn, 94 polarization)	1·615
Difference in value to refiners between Beet and Cane	·19
Beet 88° f.o.b. Hamburg, parity of Centrifugals, 96°, at New York, per lb.	3·880c.

Beet f.o.b. Hamburg. s. d.	Equal to Centrifugals at N.Y. duty paid. c.	Equal to Cuba Centrifugals c. & f. N.Y. c.	Beet f.o.b. Hamburg. s. d.	Equal to Centrifugals at N.Y. duty paid. c.	Equal to Cuba Centrifugals c. & f. N.Y. c.
6 —	3·22	1·86	8 —	3·66	2·30
6 0¾	3·23	1·87	8 0¾	3·67	2·31
6 1½	3·24	1·88	8 1½	3·69	2·33
6 2¼	3·26	1·90	8 2¼	3·70	2·34
6 3	3·27	1·91	8 3	3·71	2·35
6 3¾	3·28	1·92	8 3¾	3·73	2·37
6 4½	3·30	1·94	8 4½	3·74	2·38
6 5¼	3·31	1·95	8 5¼	3·76	2·40
6 6	3·33	1·97	8 6	3·77	2·41
6 6¾	3·34	1·98	8 6¾	3·78	2·42
6 7½	3·35	1·99	8 7½	3·80	2·44
6 8¼	3·37	2·01	8 8¼	3·81	2·45
6 9	3·38	2·02	8 9	3·82	2·46
6 9¾	3·39	2·03	8 9¾	3·84	2·48
6 10½	3·41	2·05	8 10½	3·85	2·49
6 11¼	3·42	2·06	8 11¼	3·87	2·51
7 —	3·44	2·08	9 —	3·88	2·52
7 0¾	3·45	2·09	9 0¾	3·89	2·53
7 1½	3·46	2·10	9 1½	3·91	2·55
7 2¼	3·48	2·12	9 2¼	3·92	2·56
7 3	3·49	2·13	9 3	3·93	2·57
7 3¾	3·51	2·15	9 3¾	3·95	2·59
7 4½	3·52	2·16	9 4½	3·96	2·60
7 5¼	3·53	2·17	9 5¼	3·98	2·62
7 6	3·55	2·19	9 6	3·99	2·63
7 6¾	3·56	2·20	9 6¾	4·00	2·64
7 7½	3·57	2·21	9 7½	4·01	2·65
7 8¼	3·59	2·23	9 8¼	4·03	2·67
7 9	3·60	2·24	9 9	4·04	2·68
7 9¾	3·62	2·26	9 9¾	4·06	2·70
7 10½	3·63	2·27	9 10½	4·07	2·71
7 11¼	3·64	2·28	9 11¼	4·09	2·73

Beet f.o.b. Hamburg. s.	d.	Equal to Centrifugals at N.Y. duty paid. c.	Equal to Cuba Centrifugals c. & f. N.Y. c.
10	—	4·11	2·75
10	0¾	4·12	2·76
10	1½	4·14	2·78
10	2¼	4·15	2·79
10	3	4·16	2·80
10	3¾	4·18	2·82
10	4½	4·19	2·83
10	5¼	4·20	2·84
10	6	4·21	2 85
10	6¾	4·22	2·86
10	7½	4·24	2·88
10	8¼	4·25	2·89
10	9	4·26	2·90
10	9¾	4·28	2·92
10	10½	4·29	2·93
10	11¼	4·31	2·95
11	—	4·32	2·96
11	0¾	4·33	2·97
11	1½	4·35	2·99
11	2¼	4·36	3·00
11	3	4·37	3·01
11	3¾	4·39	3·03
11	4½	4·40	3·04
11	5¼	4·42	3·06
11	6	4·43	3·07
11	6¾	4·44	3·08
11	7½	4·46	3·10
11	8¼	4·47	3·11
11	9	4·49	3·13
11	9¾	4·50	3·14
11	10½	4·51	3·15
11	11¼	4·53	3·17
12	—	4·54	3·18
12	0¾	4·55	3·19
12	1½	4·57	3·21
12	2¼	4·58	3·22
12	3	4·59	3·23
12	3¾	4·60	3·24
12	4½	4·62	3·26
12	5¼	4·64	3·28
12	6	4·65	3·29
12	6¾	4·67	3·31
12	7½	4·68	3·32
12	8¼	4·69	3·33
12	9	4·71	3·35
12	9¾	4·72	3·36
12	10½	4·73	3·37
12	11¼	4·75	3·39

Beet f.o.b. Hamburg. s.	d.	Equal to Centrifugals at N.Y. duty paid. c.	Equal to Cuba Centrifugals c. & f. N.Y. c.
13	—	4·76	3·40
13	0¾	4·78	3·42
13	1½	4·79	3·43
13	2¼	4·80	3·44
13	3	4·82	3·46
13	3¾	4·83	3·47
13	4½	4·85	3·48
13	5¼	4·86	3·49
13	6	4·87	3·50
13	6¾	4·89	3·52
13	7½	4·90	3·53
13	8¼	4·91	3·54
13	9	4·93	3·56
13	9¾	4·94	3·57
13	10½	4·95	3·58
13	11¼	4 97	3·60
14	—	4·99	3·62
14	0¾	5·00	3·63
14	1½	5·01	3·64
14	2¼	5·02	3·65
14	3	5·03	3·66
14	3¾	5·05	3·68
14	4½	5·06	3·69
14	5¼	5·08	3·71
14	6	5·09	3·72
14	6¾	5·11	3·74
14	7½	5·12	3·75
14	8¼	5·13	3·76
14	9	5·15	3·78
14	9¾	5·16	3·79
14	10½	5·17	3·80
14	11¼	5·19	3·82
15	—	5·21	3·84
15	0¾	5·22	3·85
15	1½	5·23	3·86
15	2¼	5·25	3·88
15	3	5·26	3·89
15	3¾	5·27	3·90
15	4½	5·29	3·92
15	5¼	5·30	3·93
15	6	5·31	3 94
15	6¾	5·33	3·96
15	7½	5·34	3·97
15	8¼	5·35	3·98
15	9	5·37	4·00
15	9¾	5·38	4·01
15	10½	5·40	4·03
15	11¼	5·41	4·04

To ascertain c. and f. parity of Centrifugals paying full duty, deduct ·34c. from parity of Cubas c. and f.

THE SAMPLING OF SUGARS.

By F. G. Wiechman, Ph.D.*

With the intention of securing a description of the methods used in sampling sugars in all countries interested in the sugar industry, the following circular was sent to the representatives of the United States in the different countries :—

International Commission for Uniform
Methods of Sugar Analysis.

Brooklyn, N.Y.,
November 12th, 1903.

Dear Sir,

In the last session of the International Commission for Uniform Methods of Sugar Analysis, Professor Dr. A. Herzfeld, Chairman, held in Berlin, Germany, June 4th, 1903, the undersigned was charged with securing a description of the methods of sampling sugars followed in all countries interested in the sugar industry.

Such information when collected will be referred to a committee consisting of Messrs. Wiechmann, Watt, and Strohmer, to be, by this committee, submitted to the International Commission.

In accordance with this plan of procedure, I take the liberty of requesting you to please send me information concerning the method and manner in which the sampling of sugars is at present conducted in your country.

While I shall greatly value any and all information on this subject which you may be pleased to send me, I should especially appreciate information on the following topics :—

1. Percentage of packages sampled ?
2. Approximate weight of sample taken out of each package?
3. Description of vessels in which samples are placed and transported ?
4. Is any definite time prescribed in which a given sample must be analyzed ?
5. System of analysis followed :—
    (*a*) How many analysts examine each sample ?
    (*b*) By whom are these analysts appointed ?
    (*c*) Within what limits must the results of these analysts agree ?
    (*d*) If such limits be exceeded, in what manner is the matter adjusted ?
6. Remarks.

Assuring you of a sincere appreciation of your assistance in this matter.

I am,

Very truly yours,

F. G. Wiechmann.

The replies to this circular asking for information were exceedingly prompt and courteous, a number of the gentlemen addressed having gone to considerable trouble to secure the desired information. The writer would take this opportunity to express to them, one and all,

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* Address delivered before the International Commission for Uniform Methods of Sugar Analysis, Bern, Switzerland, August, 1906.

his sincere appreciation of their courtesy and of all the trouble they have taken in this matter.

These original replies are made a part of, and are turned over to, the International Commission with this report.

For the sake of more convenient reference, however, the writer has undertaken to abstract the essential points of these reports, has tabulated the same, and has then sent this tabulation, together with the originals, to Messrs. Watt and Strohmer, with a request for any desired criticism, correction, or addition they might see fit to make.

Australia (Victoria). John P. Bray.

6. No sugar produced in the State of Victoria; is imported from Fiji and the State of Queensland. Sugar is not officially analysed in Victoria. Differentiation made only between sugar, the produce of sugar cane and other sugars, and the rate of duty chargeable is not determined by the saccharine contents.

Austria-Hungary. Hugh J. Ledoux.

1. 10%

2. From a lot of 500 bags (about 100 kilogrammes per bag) out of 25 bags are taken about 300 grammes from each bag.

3. As a rule in tin boxes, sometimes in vials with glass stoppers, which contain about 300 grammes.

4. No, but usually promptly.

5 (*a*). Two.

5 (*b*). One by buyer, one by seller.

5 (*c*). Within $\frac{1}{2}°$

5 (*d*). By third analyst.

Austria. W. A. Rublee.

1. About 1%, the purchaser, however, is entitled to 10%. (10%, correction by G. Strohmer.)

2. At least 250 grammes.

3. Glass jars with ground-in glass stoppers. Contents 250 grammes, or cylindrical tin cans, 6 cm. high and 8·5 cm. diameter.

4. About two or three days.

5 (*a*). Two.

5 (*b*). Buyer and seller; two reserve samples held for three months by buyer and seller.

5 (*c*). The arithmetical average of the two analyses made by the two sworn chemists is determinative. Limit is 0·5%.

5 (*d*). By an umpire. The average between his analysis and that of the former two nearest the same. If the umpire's analysis is exactly the mean between the two former analyses, the umpire's analysis is determinative.

6. For further details and specifications consult Jahr und Adressbuch der Zucker-Fabriken Oest.-Ungarns.

Belgium. C. Howe.

1. At discretion of buyer. 100% if desired.

2. Total weight of sugar extracted from bags about 2 kilos.

3. Glass bottles with cork stoppers, corked and sealed. Bottles may be lined with a metallic sheet. Must hold at least 100 grammes of sugar. Bottles are supplied by seller.

4. Chemists must mail report of analysis in the afternoon of second day following that of the sampling, Sundays and legal holidays not counting. Reports must bear the stamp of the Post Office.

5 (*a*). Analysis of domestic raw sugar made simultaneously by three public and certificated chemists.

5 (*b*). One by buyer, one by seller. The third by both parties. This chemist chosen by lot from official chemists in default of agreement on same by buyer and seller.

5 (*c*). Analysis of third chemist is not counted unless difference between buyer's and seller's chemist is greater than ½°. The average of the analyses constitutes the final or official analysis.

5 (*d*). If difference between first two analyses exceeds ½° the final or official analysis is fixed by taking the average of the two that approach each other the nearest. If differences are equal the average of the three analyses is taken.

Brazil. K. W. Furniss.

6. There is in Brazil no government or other supervision, sampling or testing sugars. The only samples made are by sellers, and in case sugar is intended for export such samples are submitted to a second party, usually the city laboratory for polarization. This is purely an arrangement between seller and buyer. All of the large sugar mills have laboratories for their own use, though I am informed that they make no systematic tests of their products.

Brazil. W. L. Sewell.

6. No analysis of sugar is made here. Sugars are sampled only by taste, smell, and appearance.

British Columbia. L. E. Dudley, B. J. Rogers.

1. Java baskets, sample drawn from every package. Sugar in bags, sample drawn from every third bag.

2. About 1½ oz.

3. Immediately after being taken, samples are placed in specially constructed galvanized iron bucket, provided with light cover.

6. As soon as a cargo is completed, sealed average samples are sent to the Department at Ottawa and there examined.

Denmark. R. R. Frazier.

1. 10%.

2. About a handful.

3. Tin boxes about the size of an ordinary shoe-blacking box.

4. No.

5 (*a*). One.

5 (*b*). The Danish Sugar Manufacturing Company, Limited.

5 (*c*). See 5 (*a*).

5 (*d*). See 5 (*a*).

6. There is no official sugar analysis in Denmark. Six of these seven factories in Denmark are owned by De Danske Sukkerfabrikker Aktie selskab, and the sugar produced at the seventh factory is bought by the Company mentioned. Importers in Denmark accept the test of sugar imported into Denmark from other countries.

England. Alexander Watt.

1. Beetroot sugar, 100 %. Cane sugar, about 75 %.
2. About 10 grammes.
3. Wide mouth glass bottles containing about 200 grammes.
4. Report must be sent to the Beetroot Sugar Association within ten days of receipt of sample by analyst.

5 (*a*). One or two in case of reference.

5 (*b*). One by the buyer, the other by the Beetroot Sugar Association of each town or district (London, Liverpool, or Greenock).

5 (*c*). ½ %, in the rendement, for first running sugars. 1 % for second sugars.

5 (*d*). The sample retained by the Beetroot Sugar Association goes to the analyst. The mean of the two nearest results is taken as the basis of payment.

England. H. C. Evans, J. A. Satter, Secretary; L. Eynon, Chemist, Beetroot Sugar Association.

1. 100 %.
2. About two ounces.
3. Glass bottles, capacity about 1 lb. Sealed immediately.
4. Generally within 10 days or a fortnight.

5 (*a*). Two, both analysts at the laboratory of the Association.

5 (*b*). By the council of the Association.

5 (*c*). Sucrose, not more than 0·2; ash, not more than 0·04; glucose, not more than 0·04 (a wider limit is allowed in cases where the amount of glucose is very great).

5 (*d*). If any of these limits are exceeded, the operation is repeated until agreement is obtained.

6. If the buyer's analysis of his sealed sample differs from the seller's by less than ½° on firsts and less than 1° on after-products, the mean of the two is taken as invoice basis. If the difference is greater, analysis of one of the remaining sealed samples is made by the Association chemists, and the mean of the two nearest is taken as invoice basis.

If the analysis of the seller and buyer and Association be equidistant, the mean of the three is taken.

England. J. Boyle, M. D. Heyne, Secretary, The Beetroot Association, Lancashire, Liverpool.

1. 100%
2. About ½ ounce.
3. Bottles sealed.
4. Within 10 days of receipt of sealed sample.

5 (*a*). One.

5 (*b*). The buyer. An official or public chemist.

5 (*c*). Results are compared with certificate previously handed in by seller. Difference not more than 0·5 in first products; 1·0 in after products.

5 (*d*). A reserved sealed sample is sent to the official chemist of the Beetroot Sugar Association. Settlement is made by the mean of such two of the three certificates which come nearest to each other in the results.

Scotland. J. C. Higgins.

1. Not exceeding 100 packages, 7 samples. Not exceeding 300 packages, 11 samples. Exceeding 300 packages, 15 samples.
2. Eight ounces.
3. Bottles.

5 (*a*). Nearest Customs analyst.

5 (*c*). Sampling takes place on landing of goods; if discrepancy between the entry and the analysis exceeds one degree, explanations are required.

6. Information secured from the Collector of Customs, Dundee, Scotland. All sugar imported into Dundee is entered as refined sugar exceeding 98° polarization, and therefore not sampled for analysis. When sampling is necessary, the above given method is followed.

Scotland. W. G. Harvey, Secretary, Greenock Beetroot Sugar Association, Greenock.

1. 100%
2. Bags are weighed in tallies of not more than 10 bags, and the samples of the 10 bags together weigh about six ounces. Java baskets and other large packages are sampled individually; sample taken about three ounces.
3. Glass bottles, sealed. Three to four.
4. As soon as samples are ready. Ten days' time is the limit allowed buyer to report test.

5 (*a*). Two at least.

5 (*b*). Beet sugars. Buyer and seller. The latter has analysis made in his own country.

5 (*c*). Cane sugars. Analysed by public chemists for buyer and seller. Beet sugars: In 1st products 0·5; in 2nd products 1·00

on the net analysis. Net analysis equals polarization less fruit sugar × 3, and ash × 5. If fruit sugar is over 0·25 in first runnings, or over 0·50 in second runnings, it is multiplied by five.

Cane sugars: Within 0·5 on polarization.

5 (*d*). Beet sugar: Sample is analysed by chemist of the Beetroot Sugar Association, and mean of two nearest is taken for invoice basis.

5 (*d*). Cane sugar: Analysis is made by a third public chemist named in the contract.

Egypt. F. G. Morgan.

6. The sugar industries of Egypt are in the hands of a single large company, the Societé Générale des Sucreries et de la Raffinerie d' Egypte. No regular system of analysis is used. In selling sugar to England a sample is sent out and analysed there.

France. J. K. Gowdy, L. S. Ware.

1. 10%.

2. 200 grammes.

3. Small glass bottles.

5 (*a*). Two.

5 (*b*). By seller and purchaser.

5 (*c*). 1°.

5 (*d*). A third chemist is selected and an average is taken between his polarization and the one of the two others that is nearest.

6. The cost of this third analysis, as well as the other two, is paid by the party whose chemist's analysis was the furthest from the polarization of the two others. The cost for third analysis is 10 francs.

Germany. F. H. Mason, W. A. McKillip, H. Pitcairn, E. H. L. Mummenhoff.

1. 100%.

2. Nearly 100 grammes.

3. Boxes made of tinplate nearly 1 inch in height, about 3 inches in diameter. The filled boxes are sealed by the sampler and the seller.

4. Immediately.

5 (*a*). Two, three, or more, according to agreement reached by seller and buyer.

5 (*b*). By both parties.

5 (*c*). Mostly within a few tenths of a per cent. The average of the result is decisive in such cases.

5 (*d*). The only arbiter is Prof. Dr. A. Herzfeld, Berlin. The final decision is the average between Herzfeld's analysis and that of the analyst next approaching him.

6. For further specifications and details consult Verzeichness der Rüben Zucker-fabriken und Raffinerien der Welt, Albert Rathke, Magdeburg, and Schlussschein Bedingungen des Vereins der am Zucker-handel betheiligten Firmen in Hamburg.

British Guiana (Demerara). G. H. Moulton.

1. 20% (bags of 250 lbs.)
2. Two ounces.
3. Glass bottles holding six ounces.
4. No.

5 (*a*). Two.
5 (*b*). Officers of the Government Laboratory.
5 (c). 0·1 of 1%.
5 (*d*). Refer to Government Analyst.
6. This information was obtained at the Government Laboratory.

Holland. S. Listoe, Frank D. Hill, Bloemen & Gebhard.

1. Sample representing a lot of sugar not to exceed 600 bags consists of sugar sampled from every bag.

2. About 15 grammes from each bag. With small lots, for instance, 200 or 300 bags, sample from each bag, sometimes larger.

3. 200 grammes, packed in small glass bottles or cans, which are corked and sealed by buyer and seller or their attorneys.

4. No definite time prescribed; it is customary to have analysis made immediately after taking sample. The classification samples are examined by the classifier one day after delivery of goods.

5 (*a*). Two.

5 (*b*). By buyer and seller. When less than 200 bags of one assortment, seller has to pay for both analyses.

5 (*c*). Within ½° for first products and 1° for after-products.

5 (*d*). Broker who has taken sample, sends same to Messrs. Boldingh and Van der Meide, at Amsterdam, if sample is Dutch sugar; if foreign sugar, to Dr. Hugo Schultz, or Messrs. Alberti and Hempel, at Magdeburg. Then the average of the two findings that come closest to each other, or if the difference between the three findings be the same, the middle one.

6. The extra examination is paid for by sampling broker on account of party who appointed the chemist whose analysis is not taken. When all three analyses are considered, cost of the extra analysis is shared equally by buyer and seller.

Italy. H. De Castro.

6. Two classes of sugars are distinguished: first class, whiteness superior to D.S. 20; second class, sugars coloured artificially or mixed with substances apt to alter their degree of whiteness. Sugars are chemically tested with ether to discover the colouring matter they might contain.

Jamaica. G. H. Bridgman, R. S. Gamble.

6. Sugars are shipped to the selling market in United States, Canada, or the United Kingdom, and the analyses, on which sale prices are based, are made there, and are binding on the shippers as well as on the buyers.

Japan. E. C. Bellows.

1. Percentage differs according to number of packages. For instance, two where the number does not exceed 50; three when it does not exceed 100; four when it does not exceed 200, &c. This is applicable only when the sugar is of same colour, and weight and covering of packages are similar.
2. About 1 lb.
3. Vessels made of tin-plate.
6. Duty on sugar is imposed by the colour and by the Dutch Standard; there is no necessity of analysing, and therefore there is no law or regulation as to time or method of analysis.

Mexico. A. D. Barlow, D. Bankhardt.

6. No sample taken or analysed officially. Sugar being sold on its own merits, more or less white, more or less sweet. Chemical contents of the article absolutely unknown.

Morocco. S. R. Gummere.

6. No methods or regulations for sampling sugar exist here. All imported sugar pays a duty of 10% ad valorem.

Portugal. J. H. Thierdot.

6. No analysis of sugar is made here. Purchasers draw out a small quantity through a tube to see if sugar equals sample.

Analysis made in foreign ports, exporting, is accepted in Lisbon.

Russia. E. Watts.

6. The Government not controlling the quality of sugar produced, employs no analyst for the purpose, but makes cognisance of the quantity produced.

Spain. P. G. Lopez, Julius G. Lay, R. N. Bartelman.

6. There is no fixed rule or method for analysing sugar. Sugars of all classes and origin, of whatsoever colour or degree of saccharine, pay a duty of 85 pesetas* per 100 kilos.

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* 1 peseta equal to 9½d.

West Indies (St. Croix). C. H. Payne, A. J. Blackwood.

2. About two ounces.

3. Tin kettle, with cover.

4. Once each day.

5 (*a*). One.

5 (*b*). A private analyst of the factory.

6. Aim is to produce a 96° test sugar.

West Indies (Barbados). D. F. Wilbur.

1. 100%.

2. From hogsheads about six ounces, from bags about four ounces; all drawn from centre of package.

3. Glass bottles.

4. Results are returned day after drawing sample.

5 (*a*). Two.

5 (*b*). The Government appoints a Professor of Chemistry, also an assistant. The former is empowered to appoint private assistants.

6. Results found are verified by the Professor of Chemistry.

United States of America. Treasury Department, Office of the Secretary, Washington, D.C. (Abstracted from Revised Regulations Governing the Sampling and Classification of Imported Sugars and Molasses under Act of July 24th, 1897.)

1. In sampling imported sugars the number of packages to be sampled shall conform, as far as practicable, to trade usages. Such percentages shall be sampled as in the judgment of the appraisers at the ports of New York, Philadelphia, and Boston will properly and satisfactorily represent the sugars of each mark. In the case of molasses at least 10%.

3. Large cans provided with a hasp and staple. These after being duly labelled for indentification of the mark will be locked and forwarded to the Appraiser's Office in wooden chests, if practicable, which must, in that case, be also locked.

Of sugars which have gone through a process of refining, general samples shall be made up on the wharves and placed in the tin sample boxes, furnished by the Department, each mark being kept separate.

From the general sample of raw or unrefined sugars not above No. 16 Dutch standard, two round tin sample boxes of uniform size, made to contain not less than 1 lb. each, shall be closely packed full of sugar. The boxes must be practically air-tight when closed.

4. Samples collected in the morning and afternoon of each day; samples must be tested promptly on arrival at the Appraiser's stores.

5 (*a*). At least two.

5 (*b*). By the Government.

5 (*c*). Within 0·3 of 1°, the average of the two shall be accepted as the test.

5 (*d*). A third test of the sample after remixture of the two previously analysed is made by a third expert when practicable. Of the three tests so made, the average of the two most closely corresponding shall be accepted as the test of the sample, provided the two last mentioned tests correspond within 0·3 of the 1°; and provided further, that if one of the three tests so made be the average of the other two tests, and corresponds with the same within 0·3 of 1°, then such test shall be accepted as the test of the sample.

When two of the three tests so made do not correspond within 0·3 of 1°, a fourth test of the sample shall be made, which shall be subject to the same provisions as herein prescribed with reference to the preceding tests; but discrepancies rendering such fourth test necessary should not occur.

In conclusion the writer begs to submit suggestions made respectively by Mr. Alexander Watt and by himself regarding :—

1. Percentage of packages to be sampled.

Watt.	*Wiechmann.*
100% Every package to be sampled with a trier.	100% Every package to be sampled with a trier.

2. Approximate weight of sample to be taken out of each package.

Watt.	*Wiechmann.*
25 grammes for beet sugars, 50 grammes for cane sugars.	Same amount in every kind of sugar. Length of trier and its shape to be agreed upon and prescribed. Amount of sample to be 100 grams in each case.

3. Description of vessels in which samples are to be placed and transported.

Watt.	*Wiechmann.*
Three to five samples in glass bottles corked and sealed. Bottles for beet sugars to contain 250 grams; for cane sugars 500 grams.	Original sample is to be put in closed metal receiver. Of this five samples in glass bottles corked and sealed. Each bottle to contain 500 grams.

4. Time limit in which a given sample is to be analysed.

Watt.	*Wiechmann.*
Seven days from receipt by analyst.	Two days. Sundays and holidays not to count.

5 (*a and b*). The number of analysts to examine each sample, the appointment of these analysts, the limits within which the results of these analysts must agree, and the adjustment of the matter in case the limits prescribed be exceeded.

Watt.	*Wiechmann.*
3 { Buyer's Analyst. Seller's Analyst. Referee's Analyst.	3 { Buyer's Analyst. Seller's Analyst. Referee's Analyst. Referee to be agreed upon by buyer and seller in advance of making analyses.
5 (*c*). Beet sugar— 1st Rend. ·5% 2nd Rend. 1·0% Cane sugar— Pol. ·5%	Beet sugar— 1st Rend. ·5% 2nd Rend. ·5% Cane sugar— Pol. ·5%
5 (*d*). Mean of buyer's and seller's analyses when difference does not exceed limit. Mean of two nearest when three analyses are made.	Mean of buyer's and seller's analyses when difference does not exceed limit. Mean of two nearest when three analyses are made.

QUEENSLAND.

The Government Central Mills.

II. *Some Statistics.*

The adjoining tables, giving the average of manufacturing results at the central sugar mills under the control of the Queensland Government, will be found of sufficient interest to be worth reproducing in full from the "Annual Report upon the Government Central Sugar Mills," as prepared by Dr. Maxwell. In a previous number of this Journal we gave some details of the working arrangements in force at these mills, and we now supplement these details with some figures.

MILLING.

MILLS.	Cane Crushed.	No. of Hours Crushing.	Crushed per Hour.	Sugar in Cane.	Fibre in Cane.	Normal Juice.	Mixed Juice.	Maceration per 100 of Normal Juice.	Sugar extracted per 100 of Cane.
	Tons.		Tons.	Per cent.	Per cent.	Gallons.	Gallons.		
Proserpine	26,424·53	1,187·81	22·24	12·86	11·76	4,693,431	6,375,087	35·83	91·32
Pleystowe..	19,851·56	846·16	23·46	14·46	11·45	3,593,726	4,851,530	35·00	92·74
Gin Gin..	22,905·72	1,263·85	18·12	12·12	10·63	....	(4,436,290)	10·66	87·95
Mount Bauple	15,359·11	970·1	15·82	13·82	11·46	2,690,302	3,407,806	26·67	88·04
Moreton..	41,675·26	3,119·91	13·36	12·48	10·96	7,336,123	8,556,121	16·63	90·05
Nerang River	10,437·57	990·69	10·54	10·69	11·00	....	1,860,508	....	87·61

PROCESS OF MANUFACTURE.

MILLS.	Normal Juice.					Mixed Juice.				
	Brix.	Sucrose.	Purity.	Glucose	Glucose.	Brix.	Sucrose.	Purity.	Glucose.	Glucose.
	Per cent.	Per cent.	Per cent.	Per cent.	Ratio.	Per cent.	Per cent.	Per cent.	Per cent.	Ratio
Proserpine	17·16	14·94	87·05	·83	5·55	12·18	10·39	85·30	·55	5·29
Pleystowe	19·06	16·72	87·72	·94	5·62	13·61	11·65	85·59	·65	5·58
Gin Gin	16·45	13·77	83·71	1·04	7·55	14·33	11·82	82·46	·89	7·53
Mount Bauple	18·12	15·86	87·53	·69	4·35	13·79	11·64	84·41	·41	3·52
Moreton	16·45	14·30	86·93	1·10	7·69	13·59	11·59	85·28	·89	7·68

PROCESS OF MANUFACTURE.—*Continued.*

MILLS.	Syrup.						First Molasses.					
	Brix.	Sucrose.	Purity.	Glucose.	Glucose.	1st Massecuite.	Brix.	Sucrose.	Purity.	Glucose.	Glucose.	2nd Massecuite.
	Per cent.	Per cent.	Per cent.	Per cent.	Ratio.	Quotient Purity.	Per cent.	Per cent.	Per cent.	Per cent.	Ratio.	Quotient Purity.
Proserpine	56·66	49·77	87·84	2·80	5·60	88·81	82·17	57·71	70·23	9·00	15·59	73·87
Pleystowe	58·05	49·96	86·06	2·78	5·56	86·80	81·69	50·72	62·08	6·81	13·42	..
Gin Gin	56·03	47·69	85·11	3·48	7·29	85·06	79·52	54·30	68·28	12·93	23·81	75·47
Mount Bauple ..	56·12	48·12	85·74	2·11	4·38	89·71	(78·86	57·24	72·71	6·30	11·00)	76·62
Moreton	59·92	51·88	86·58	3·83	7·38	..	83·07	51·37	65·45	12·31	22·82	..

MILLS.	Second Molasses.					First Jelly.	
	Brix.	Sucrose.	Purity.	Glucose.	Glucose.	Quotient Purity.	Gallons made per Ton of Cane. (85° Brix.)
	Per cent.	Per cent.	Per cent.	Per cent.	Ratio.		
Proserpine	87·74	45·09	51·39	15·20	33·75	55·30	5·13
Pleystowe	78·62	36·46	46·37	12·27	33·65	53·50	4·66
Gin Gin	79·29	45·40	57·26	15·96	35·36	56·77	5·51
Mount Bauple	(80·57	50·75	62·99	9·03	17·79)	(61·79)	4·89
Moreton	86·33	46·36	54·28	17·56	37·52	46·97	5·26

PROCESS OF MANUFACTURE.—*Continued.*

MILLS.	Residues.											
	First Megass.		Second Megass.					Press Cake.				
	Water.	Sucrose.	Water.	Sucrose.	Weight of Megass.	Sugar in Megass.		Water.	Sucrose.	Weight of Cakes.	Sucrose in Cake.	
						Tons.	In per 100 of Cane.				Tons.	Per 100 of Cane.
	Per cent.	Per cent.	Per cent.	Per cent.	Tons.			Per cent.	Per cent.	Tons.		
Proserpine	60·68	9·37	48·40	4·28	6,882·41	295·01	8·68	60·17	6·27	314·43	19·72	·58
Pleystowe	56·61	8·18	45·36	4·39	4,731·84	207·98	7·26	49·21	4·28	166·53	7·14	·25
Gin Gin	60·40	7·45	51·03	5·58	5,996·11	334·64	12·05	58·56	6·86	211·41	14·51	52
Mount Bauple ..	59·15	9·45	51·41	5·76	4,406·09	254·07	11·96	55·47	6·31	167·30	10·55	·49
Moreton	60·04	8·41	51·56	4·69	11,026·22	517·48	9·95	60·49	8·03	511·70	41·13	·79

MILLS.	Final Molasses (Made and Estimated).				
	Brix.	Sucrose.	Purity.	Weight of Molasses.	Sugar in Molasses.
	Per cent.	Per cent.	Per cent.	Tons.	Tons.
Proserpine	76·59	31·48	41·10	662·89	208·68
Pleystowe	....	....	....	....	176·65
Gin Gin	79·23	36·86	46·53	753·98	277·92
Mount Bauple..	....	....	....	....	186·91
Moreton	88·18	35·55	40·31	1,179·46	420·49

SUGARS MADE.

Mills.	No. I. Sugar.			No. II. Sugar			No. III. Sugar (Made and Estimated).			Sugar in Tanks.	Total Sugar made, calculated on 100% Purity.
	Tons.	Polarization.	Water.	Tons.	Polarization.	Water.	Tons.	Polarization.	Water.		
		Per cent.	Per cent.		Per cent.	Per cent.		Per cent.	Per c nt.		Tons.
Proserpine	1,957·72	97·66	·87	592·00	96·08	1·29	....	89·23	3·89	....	2,676·39
	1,912·00	100·00	..	568·81	100.00	..	195·58	100·00	..	....	78·74 %
Pleystowe	2,194·60	97·44	·80	....	....	..	....	89·35	3·65	....	2,239·24
	2,138·43	100·00	..	520·00	....	..	100·79	100·00	..	....	78·16 %
Gin Gin	1,519·30	97·64	·68	520·60	96·15	1·11	(Estimat	ed less re	melted)	....	2,057·71
	1,483·43	100·00	..	500·60	100·00	..	73·68	100·00	..	. ..	74·11 %
Mount Bauple	1,031·61	98·70	·51	382·12	97·45	·69	....	86·48	3·03	....	1,505·48
	1,018·25	100·00	..	372·38	100·00	..	114·85	100·00	..	....	70·89 %
Moreton	3,555·50	97·98	·63	263·90	97·09	·87	(Estimat	d less re	melted)	....	3,868·87
	3,483·72	100·00	..	256·23	100·00	..	134·32	100·00	..	....	74·37 %

RESULTS.

MILLS.	Sugar in Cane entering Mill.	Sugar entering Manufacture.	Loss at the Rollers.	Loss in Process of Manufacture.	Total Loss of Sugar.
	Tons.	Tons.	Tons.	Tons.	Tons.
Proserpine ..	3,399·16	3,104·15	295·01	427·76	722·77
	100·00 %	91·32 %	8·68 %	12·58 %	21·26 %
Pleystowe ..	2,865·04	2,657·06	207·98	417·84	625·82
	100·00 %	92·74 %	7·26 %	14·58 %	21·84 %
Gin Gin	2,776·60	2,441·96	334·64	384·25	718·89
	100·00 %	87·95 %	12·05 %	13·84 %	25 89 %
Mount Bauple..	2,123·56	1,869·49	254·07	364·01	618·08
	100·00 %	88·04 %	11·96 %	17·15 %	29·11 %
Moreton	5,202·48	4,865·00	517·48	816·13	1,333·61
	100·00 %	90·05 %	9·95 %	15·68 %	25·63 %

The following facts must be taken into account in studying the tables:—

The quality of the cane (sugar in cane) should always be considered. At the Gin Gin, Moreton, and Nerang mills the cane was practically all frosted, and the greater part actually killed. The Comptroller thereupon gave instructions that those mills were to work at the greatest possible speed in order that the whole of the crop could be put through the rollers before fermentation should render the frosted cane unfit for milling. Therefore, a greater tonnage per hour and per week was crushed than the standard of capacity of the respective mills calls for; but the extraction was reduced in consequence. Instead of extracting over 90 per cent., two of the mills obtained only 88 per cent., which was the first and initial loss that could not be recovered. The total crops, however, were put through the rollers in the shortest possible time, and every farmer received full payment for his deliveries.

The killing of the cane by frost also interfered with the recovery of the sugar. When cane is frosted or diseased, the juices are affected by fermentations, which result in abnormal quantities and kinds of gummy bodies being formed; and these bodies hold back the sugar from crystallizing in the molasses. Especially at the Gin Gin and Moreton Mills were these conditions severely experienced in 1905, in dealing with the recovery of the sugars. At Mount Bauple the effect of frost was less, the high loss of sugar being due to preventible causes, which the Comptroller has already signified, and has given instructions in respect to mill work that will lower the loss. At the

Proserpine and Pleystowe Mills, it is seen that the quality of the cane, which was totally free from frost, was very superior to three of the Southern mills, and that the extraction was also well over 90 per cent. Especially at Pleystowe were the quality of the cane and the extraction far above the other mills. The Pleystowe Mill, however, with the superior juice, and free from frost, had a loss of 14½ per cent. in the after processes of manufacture, the Proserpine Mill losing 12½ per cent. during the same processes. There is still a notable margin for the reduction of preventible losses at all the mills, but especially at those where the climatic conditions allow the cane to be manufactured when the analyses show that it is at its best. Where frost comes down on the crop, it has to be treated at once, and at great loss; for the frost, when the cane is killed, not only stops further improvement, but the damage has been done before the cane has become anything like mature. At most of the mills, however, the standard of work in 1905 was higher than had been previously obtained, and the putting in of additional crushing power at mills, where such is found to be practicable, is expected to furnish still higher and paying results.

The balance sheets of the mills for the year ending June 30th, 1906, reveal a net profit in the case of four mills and a loss in two. The Moreton mill, which had a debit balance of £4,606 at the time the Treasurer went into possession (January 1st, 1904), had a credit balance on June 30th last of £13,150. The Gin Gin Mill showed a loss on December 31st, 1903, of £581 and now comes out with a credit balance of £592. The Mount Bauple Mill had an adverse balance of £6,165 on December 31st, 1903, and as in the following two years the net profits only came to £3,986, there still remains a debit balance of £2,179 to be worked off. Proserpine Mill started similarly with a debt of £5,069, and gaining £5,523 in 18 months ending June, 1905, to be followed with £931 during 1905-06, comes out with £1,385 to its credit. The Nerang River Mill has the worst record, showing to date a debit balance of £6;155 or an increase of 50% on the adverse balance registered on December 31st, 1903. Pleystowe, the last to be recorded, starting on January 1st, 1904, with a debit balance of £2,940, now shows a credit balance of £4,589.*

The American Sugar Refining Company has recently been fined heavily for accepting rebates from the railway companies in contravention of the law. For the same offence the New York Central Railroad were mulcted to the extent of £21,600.

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* The figure given in the *Report*, viz. £2,940, is an obvious slip,

A NEW SUGAR-CANE PEST IN TRINIDAD.

During the past few months sugar-canes in Trinidad have been attacked by a small insect of the group known as spittle insects or frog-hoppers.

The name spittle insect is given on account of the peculiarity of the immature insect in covering itself in a mass of white froth which is voided from the tip of the abdomen, and which forms a complete hiding-place or covering for the insect within. The name frog-hoppers was probably derived from the name of frog-spittle, formerly given to the frothy mass, and from the leaping habit of the adult.

The frog-hoppers belong to the family *Cercopidae*, of the order Hemiptera, and are therefore related to the principal insect pests with sucking mouth-parts, such as scale insects, plant lice, plant bugs, cotton stainers, &c.

Specimens of infected cane stumps and of the adult insect have been forwarded from Trinidad to the Head Office of the Imperial Department of Agriculture, and the following account is based on examination of these specimens.

The adult insect is about $\frac{5}{16}$ inch in length, and about half as wide. The head and thorax are dark greenish, the wing-covers light-brown with two narrow whitish bands running across them. The head is stout and broad, the eyes prominent, and there are two small simple eyes on the upper surface of the head between the large compound eyes. The antennae are short and hair-like, except the base, which is much thickened. The legs are dark-brown and slender; the wing-covers are somewhat thickened, while the under wings are pale, tinged with smoky-brown, and with violaceous reflections. The immature specimens, so far examined, are all in the last larval stage of development. The bodies are whitish, tinged with pink or red, the head and thorax being darker. The developing wings are seen as dark, elongated pads lying on the basal part of the abdomen.

The adults have not been observed in the act of feeding. The immature insects seem always to place themselves on young tender roots, and it is probable that they are unable to penetrate the hard rind of the cane with their beaks. They have been found feeding at a distance of four inches below the surface of the soil.

Mr. J. H. Hart, in a letter to the Imperial Commissioner of Agriculture, states that this insect appeared a few years ago in Trinidad, during such a season of constant wet weather as the present has been, and the fact that it has remained comparatively unknown since that time would indicate that it becomes a pest only in seasons unfavourable to the cane.

The insect will probably prove to be a species of *Tomaspis*, perhaps *T. bicincta*.

It may be added that the specimens of cane stumps forwarded for examination were attacked by the root fungus (*Marasmius*), and several of the canes had been completely tunnelled out by some boring insect, so that it is quite likely that the unfavourable condition of the cane fields from which the specimens were taken may be largely due to other causes than the frog-hoppers.—(*Agricultural News.*)

THE WORLD'S COMMERCE.

By John J. Macfarlane.

A very interesting and instructive article on the World's Commerce from 1850 to 1905 has recently appeared in *Commercial America*, a journal issued by the Philadelphia Commercial Museum, giving figures which show the expansion of trade in various countries during the last fifty years. Being written from an American standpoint, one may not agree with all the conclusions drawn, but taking the facts as a whole, they form a fair statement of the case. Below will be found as much of the paper as we can conveniently reproduce, but as this does not include a number of charts which tersely illustrate the text, those of our readers who desire to study the question at length are advised to get a copy of the original*

Foreign commerce, as we know it, is largely the result of the introduction of machinery and the development of the factory system. These have made it possible for one man to produce as much as a hundred could a century ago. The exchange of products between different countries is simply extending to nations the principle of the division of labour, which already has done so much to increase the efficiency of individuals and communities.

Formerly, the wants of each locality were mainly supplied from its own, or a not far distant neighbourhood, and very little was obtained from foreign countries. Now, Great Britain and other manufacturing nations are dependent for a large part of their food products and raw materials upon other countries, which in return purchase their manufactured products.† The largest manufacturing countries are, therefore, the leading commercial nations of the world.

The combined exports and imports of the whole world in 1800 were 100 million dollars less than the exports of the United States in 1905. In the following fifty years (1800–1850) the world's commerce increased 166 per cent., and in the last fifty-five years (1850–1905) it increased 562 per cent. This extraordinary development was largely due to the increased facilities for communication on both land and sea, which greatly reduced freight rates, and to the exports of capital largely

* To be procured of the Publication Department, Philadelphia Commercial Museum, Philadelphia.

† This "return purchase" is becoming "beautifully less" every year.—[*Ed. I.S.J.*]

from England, but also from other European nations, to less developed countries. This capital was exported in the shape of loans for building railways and developing the industries of countries like the United States, Argentina, Canada, Australia, South Africa, and India, and also some of the less advanced European countries.

After centuries of protection, Great Britain had secured the monopoly of the leading manufacturing industries of the world. Owing to its freedom from devastating wars for a long period, it had also accumulated large amounts of convertible capital. The conjunction of these two factors made it possible as well as politic for it to adopt free trade in 1847. The extraordinary increase in the trade of the world in the decade following (1850-1860) has been ascribed to the effect of the passage of this law. If, however, a correct analysis were possible, it would be found that the exports of the capital which it had accumulated had more to do with this rapid increase of foreign trade than the passage of the free trade act. While the trade of Great Britain during these ten years increased 110 per cent., that of the United States increased 123 per cent. and that of France 122 per cent.

The British percentage of the world's trade, which in 1850 was 20, decreased to 17 in 1905, while that of the United States, which was 7½ in 1850, increased to 10½ in 1905. During the last fifty years the trade of Great Britain has increased 273 per cent., while that of the United States has increased 500 per cent. Of course these figures merely show the actual exchange of merchandise and do not take into consideration exports of capital, freight and other important factors.

COUNTRIES INCREASING THEIR TRADE.

The following countries increased their imports over 100 million dollars since 1884 :—

	Millions of dollars		Millions of dollars
Germany	827	Italy	147
Great Britain	783	Canada	146
United States	550	China	144
Netherlands	518	Argentina	115
Belgium	281	Switzerland	115
Japan	218	India	105
Austria Hungary	191		

The following countries increased their exports over 100 million dollars since 1884 :—

	Millions of dollars		Millions of dollars
United States	867	Austria Hungary	168
Germany	595	India	151
Great Britain	472	Australia	139
Netherlands	461	Japan	129
France	300	Italy	126
Argentina	257	Cape Colony	125
Russia	250	Canada	120
Belgium	170	Brazil	133

Manufacturing Countries Lead in Commerce.

From the above tables it will be seen that the three leading manufacturing countries, United States, Great Britain and Germany, exceed all others in the increase of the value of imports and exports since 1884. Germany leads in the increase in the value of imports and the United States in the increase in the value of exports.

The *percentage* of increase in trade since 1884 in the three leading countries is as follows:—

	Imports.	Exports.
United States	87	118
Germany	106	78
Great Britain	49	41

In the newly-developed countries the *percentage* of increase since 1884 is generally much larger. In imports, Japan increased 872 per cent.; Mexico, 258; Cape Colony, 288; Argentina, 127, and Canada, 125. In exports, Japan increased 440 per cent.; Argentina, 390; Cape Colony, 380; Mexico, 178; Brazil, 158; Canada, 130, and Australia, 100.

Commerce of Smaller Countries.

The imports and exports of a number of smaller countries are given in millions of dollars in the following table:—

	Imports.	Exports.
Algeria	73	54
Bulgaria	24	29
British West Indies	33	28
Ceylon	37	38
Chili	57	78
Dutch East Indies	78	110
Greece	26	17
Hawaii	14	37
Indo China (French)	35	30
Natal	53	11
New Zealand	64	73
Norway	84	58
Persia	28	20
Peru	21	20
Philippines	30	33
Portugal	67	33
Rumania	60	50
Siam	21	28
Turkey	119	81
Uruguay	21	39

Centralization of Business follows that of Political Power.

The centralization of political power as a result of the War for the Union in the United States and the Franco-German war in Europe, whereby in one case the permanency of the union of the States was

established in 1865, and in the other the German Empire was created in 1870, had a great effect on the business of the world. The opening of the Suez Canal also largely affected the world's commerce, and all of these combined make the year 1870 a convenient date from which to review the world's trade.

The centralization of business enterprises followed that of political power, and in the last ten years has produced results such as the world has never seen before. In the nine years since 1896 the world's commerce increased 50 per cent., or more than in the preceding twenty-seven years. Corporations, combines, trusts, cartels and other forms of business combinations, in spite of all their faults, have aided in the development of the manufactures and commerce of both the United States and Germany. To-day these countries contest British supremacy in both manufactures and commerce. The United States has already far surpassed Great Britain in the value of the output of its manufacturing industries, and competes with it for first place in the export of domestic products.

Great Britain far exceeds all other nations in the value of its imports. The increase of the imports of these four nations has been greater in the ten years since 1895 than in the preceding twenty-five years—in the case of Germany, 250 per cent., and of Great Britain and the United States, 50 per cent. greater.

The panic of 1873 caused a great fall in the imports of the United States, without any great effect on the import trade of the other nations. That of 1883 affected the imports into Great Britain more than those into either of the other countries.

In exports, the effects of the panics of 1873 and 1883 are very marked in the case of Great Britain, and the effect of the Baring failure in 1890 is shown in the falling off of the exports after having reached a new high record. The exports from Great Britain in 1872 amounted to 1246 million dollars, and did not again reach that mark until 1899, except in one year, 1890. The general rise of exports since 1896 in all four countries is very noticeable, more especially in the United States.

United States gains first place in Exports.

In 1898 the United States, for the first time, exceeded Great Britain in the value of its exports, as it has done in 1900, 1901, and 1903. It was only about six millions behind Great Britain in 1905. If the exports to Hawaii and Porto Rico were added in order to compare the United States with former years, the United States' exports in 1905 would be 1627 millions against 1606 millions for Great Britain.

There has appeared recently in many papers the statement that the value of the exports of domestic products from the United States in

1905 was $1,621,581,000, although the same papers only a few months ago gave the correct amount, as published by the United States Government, $1,599,420,000. This discrepancy has arisen in a curious way. *The Board of Trade Journal,* published in London, in making a comparison of the trade of the leading nations of the world for 1905, gives the United States' exports as £333,213,000, or three millions more than Great Britain. They arrived at the amount for the United States by dividing $1,599,420,000 by 480, the value in cents which they allow to a pound sterling in making statistical calculations. In converting this table back to dollars, the 333 million pounds were multiplied by 486·65, the value in cents allowed to a pound by the exchange tables published by the United States Government. This gives $1,621,581,000, or 22 million dollars more than the correct value.

We are only still at the commencement of the growth of international trade, and there is no doubt but that future years will see greater expansion of foreign commerce than we have had in our day. Trade generally moves in cycles of ten years, as the panics of 1873, '83, and '93 would indicate. We have passed 1903, but it is highly probable that 1906 will end for the present the advancing wave in foreign trade. The low point of each receding wave has been higher than that of the preceding one and it is hardly likely that the next low point will reach that of 1894 or '95.

Race for Commercial Supremacy.

Three nations are in the forefront of the race for commercial supremacy, Great Britain with its enormous imports, is still the leader. The excess of imports, which has averaged 860 millions dollars the last ten years, is thought by some to be an indication that it is living on its capital. When the interest from investments on capital in foreign countries, the returns for freight, insurance, banking and brokerage charges on foreign commerce are taken into consideration they will be found to offset the most, if not all, of this excess. Great Britain can hardly be said to have entered into its decadence so long as its per capita imports and exports are greater than those of its rivals.

When the Dingley Tariff Bill was passed in 1897 its opponents prophesied that our foreign trade would decrease, but instead of that both imports and exports are now greater than ever before. In the United States and Germany, both protective countries, foreign trade has increased more rapidly than in Great Britain. The increase in the United States of 800 millions in exports in ten years exceeds that of any other nation in any similar period, and the increase of imports in Germany was more than that of Great Britain during the same period.

The exports of the United States have exceeded its imports since 1876 with the exception of two years.* The average excess of exports during the last ten years has been 450 million dollars. This excess is used to pay freight and insurance on the *ninety* per cent. of our trade carried in foreign vessels—the interest on foreign investments in the United States—the money expended by Americans travelling in European and other countries—and the money sent abroad by foreigners resident in the United States.

It is in the increase of the exports of manufactured goods, however, that both nations are making inroads into the trade of Great Britain. During the last ten years the United States has increased its exports of manufactured goods 388 million dollars, or 212 per cent., Germany 365 millions, or 67 per cent., and Great Britain 362 millions, or 38 per cent.

England's long supremacy in foreign trade has made its merchants imagine that there is not the same necessity for them to "hustle" as there is for their American cousins, and they waste the energy that might be used in the counting house, the machine shop, and the laboratory, in yachting, at the bridge table or on the golf links and cricket field.

Effect of the South African War on British character.

The Statist, London, says, "The real cause of the unsatisfactory economic conditions of this country (Great Britain) during recent years is that we had become inefficient. We had held the first place in trade and manufactures for so long a time that we had come to look upon ourselves as beyond the reach of competition. We had grown slothful and lazy. We had lost much of our old spirit of enterprise. We contented ourselves with machinery that, if not obsolete, was obsolescent. And what the war in South Africa really did was to disclose to ourselves, as well as to the rest of the world, that we were no longer the energetic, enterprising and efficient people we had so long been. The disclosure has had excellent effects, and we hope that with a better system of education and with improved institutions the country will once more give proof that it is capable of holding its own against all competitors."

The facts already given will enable the reader to see for himself the course of the world's trade. In connection with these we give the opinions of two English authorities on the increased trade of the United States and the reasons for it.

Causes of the success of the United States and Germany.

Shadwell in his "Industrial Efficiency" gives protection as one of the reasons for the success of the United States and Germany, saying, "It is undeniable that protection, with its corollaries does give the protected competitor a great immediate economic advantage over unpro-

tected ones," but adds that "tariffs alone, though they be raised as high as Haman's gallows, could not do for Germany and America what they have done by other means." He sums up under the word "work" all the other various causes of the success of the United States and Germany. He still further says, "the industrial success which has 'outstripped' England has been reached by widely different roads in Germany and America; in the latter by the almost unaided efforts of the persons engaged in industry; in the former by the co-operation and interplay of a large number of factors, of which industrial effort is only one, though the most important."

American method of work.

"The American method of work in the industrial sphere is distinguished by the following features: enterprise, audacity, push, restlessness, eagerness for novelty, inventiveness, emulation and cupidity. Employers and employed have exhibited the same in their degree. The manufacturer aims at extending his business, he takes up novelties, encourages inventions, studies the market, tries devices to increase the output and diminish cost. Hence, for instance, the standardization of products, the organization of the workshops, the demand for highly educated officers, and the alert control exercised by large combinations, which enable a central authority to check the management of each component by the results of the rest, and to screw up any that are growing slack. The employed are eager to learn as much as possible and to better themselves. Both are absorbed in their occupation, and bend all their energies to it."

German method of work.

"The industrial expansion of Germany presents another picture. It has been achieved equally by hard work, but the adventurous audacity and restless search for novelty of America have been replaced by steady and watchful effort. The circumstances of the country, not less than the national character, have imposed this difference. But there is another not less striking—the industrial population has not been left to carve out its own destiny, but has been guided and helped at every step. All sections of the community, from the throne to the workhouse, have contributed something. *Ordered regulation* is accepted and applied with infinite pains by the legislature, government departments, municipalities and private citizens. It is seen not only in the scientific tariff but in the careful and judicious factory code, the state system of insurance, the organization of traffic and transport by railway and canal, the fostering of the mercantile marine, the educational provision, municipal action and poor law administration. So the edifice has been built up four-square and buttressed about on every side. It is a wonderful achievement in which every unit has played a part, and the spirit which has brought it about is the spirit of duty and work. Here is the explanation of

the two remarkable facts that a comparatively poor country, labouring under considerable natural disabilities, has raised itself to the very front rank of industrial productivity, and that its poorer classes, though far less favoured by circumstances, yet maintain a higher level of well-being and a far higher level of vitality than those of its wealthier rivals. And to those may be added a third—the power of making an exceptionally quick recovery from depression caused by the fluctuations of trade. Germany compels admiration."

While Shadwell says elsewhere that German thoroughness is more apt in the long run to give them the lead in foreign trade, he loses sight of the fact of the possibilities in the United States for an increased population, an enormous development of manufacturing industries and large accumulations of capital. These combined will continue the United States in the position which it now has as the leading manufacturing nation, and give it a larger surplus for export than Germany,

FUTURE OF THE UNITED STATES' TRADE.

Another Englishman, Commercial Agent Bell, makes the following statement, which is probably a correct prophecy of the future of the United States' trade:—

"In dealing with the exports from the United States during 1905, the first thing that strikes one is the fact that notwithstanding the enormous volume of the home trade, the value of manufactured articles exported should have increased to such an extent. If this is possible during such times as these, when every industry is fully occupied, it is not difficult to imagine what will be the result when the home demand slackens and when the manufacturers who have so greatly enlarged and extended their works to meet the extra demand for their products are obliged to look for extended markets outside the United States in order to keep their mills and factories fully employed. When it is remembered that it is only by keeping their works running to the fullest extent and thus keeping down expenses to the lowest point that renders it possible for the majority of the manufacturers in the country to compete in foreign markets, one can realize how essential it is that they find neutral markets where their surplus products can be disposed of so as to avoid accumulation of stocks.

"There are no signs at present of this great activity decreasing. On the contrary, there is every indication that the present year will be quite as prosperous as the past or more so. The country was never more prosperous than at present. Industrial operations are carried on upon a larger scale than ever."

The Colonial Sugar Refining Co., Ltd., of Sydney, has shown a profit for the half-year ending September last of £111,679, which has allowed a dividend of 10% per annum. The reserves now stand at £420,132.

THE WANT OF AN EFFICIENT CANE HARVESTER.

The scarcity and cost of field labour in Louisiana constitute an increasingly serious menace to the sugar interests of that State. When the grinding season comes round labour prices are at a premium, and the planters are materially handicapped by the difficulties they experience in getting a regular supply of canes from the field to the factory. It is unnecessary in Demerara to refer to the loss involved when interruptions occur in the course of the grinding. At the present moment the situation created by the lack of field-hands in Louisiana is said to be actually precarious, and the circumstance explains the eagerness with which the sugar planters of the State grasp at any mechanical invention calculated to replace the labour of the workman either in field or factory. The want of the moment, however, has still to be supplied. The sugar proprietors are waiting impatiently for the advent of an efficient cane harvester which will do the work of cane cutting now done by hand. This is an invention upon which the minds of the Louisiana planters are very intently set. They offer a substantial award to the man who can make practicable the harvesting of the canes by a mechanical agency. Such a discovery is "the great problem" the solution of which, all are confident, will be reached sooner or later, its coming meaning "the salvation of the sugar industry in Louisiana." Inventions have been submitted again and again to meet the difficulty, but thus far none of them have proved to be of any practical value on trial. Just now several machines of the kind are being experimented with, but the indications hold out little promise that the problem has yet been solved. As approximately five million tons of sugar cane are grown annually in the Louisiana sugar belt alone (without reckoning on the large areas devoted to the cultivation of canes in other adjoining States which are not used for sugar manufacture), and as the harvesting must be accomplished within a period of from sixty to seventy days, it will be readily understood what a volume of labour the task calls for every year. The mystery is that the work can be completed at all, when we consider that at ordinary seasons the labour available is hardly sufficient to maintain the cultivation at a proper level. As we have indicated, the planters of Louisiana are sanguine that before long the intensely-desired harvesting device will be placed on the market. One of the troubles of the inventors has been to turn out a piece of mechanism which will deal satisfactorily with the straggling canes whose habits of growth are not upright. Looking at the average cane-field in Demerara, it would seem a hopeless task ever to construct a harvesting contrivance which would be suitable for use locally. But in Louisiana the canes are less vigorous in their growth and are invariably more erect in their habits. The problem of the inventor is therefore much less formidable in the American sugar

State, and, as a matter of fact, this difficulty is actually diminishing in Louisiana. By their general use of the popular straight-growing Demerara seedling varieties Nos. 74 and 95, the sugar planters of the State, we are informed, "are smoothing the road for the coming of the cane harvester." Within a few years, it is anticipated, fully one-half of the cane grown in the State will in all probability consist of these seedlings. In the event of the success of some new implemental harvesting device being established, says a Louisiana paper, "we may expect to see the area planted in Demerara canes increased to three-fourths of the entire crop, the remaining quarter being retained in home canes in consideration of their acknowledged characteristic of ripening sooner than their more erect rivals, thus permitting the start of grinding earlier than would be possible were the former grown exclusively."—(*Demerara Chronicle.*)

THE INFLUENCE OF STRIPPING ON THE YIELDS OF CANE AND SUGAR.*

By C. F. Eckart.

Probably no subject relating to the field operations of the sugar industry in the Hawaiian Islands has been more freely discussed by plantation managers than that of stripping, or the removal of dried leaves from the cane stalk. Widely divergent opinions are held as to the economy of this expensive practice, and owing to the radically different conditions under which such cane is grown in this country it is natural that the experience of some plantations, in this particular, has not always been in conformance with that of others. The question is largely a local one, and the profits or losses from stripping are determined by the conditions under which the operation is performed. These controlling factors have, in recent years, become so involved through the ravages wrought by the leaf-hopper pest and fungus diseases that the most careful judgment is now required to determine whether or not the practice may be employed to advantage in any given instance.

The object of this paper is to present such data as have been obtained from carefully conducted stripping tests at the Experiment Station. While these experiments were naturally carried out under conditions quite dissimilar in many respects from the conditions which prevail on many plantations, the importance of the results yielded by the tests cannot be sufficiently emphasized. It is true that the soil, climatic, entomological, and pathological factors which influence the growth of the cane in the Experiment Station field may be very different in their proportional values from those which control the general plantation yields, but it is also true that two fields may be

* Abridged from Bulletin No. 16 of Hawaiian Sugar Planters' Association.

found on nearly all of the plantations which differ from each other to an almost equal extent. It would be far from reasonable to suppose that the results from such stripping experiments as are described in these pages would hold good for all of the plantations in the group, and it would be quite as unreasonable to consider them (taking them in a general way) as applying only to that particular spot in the Hawaiian Islands where they were carried out. The results show that under certain conditions, thousands of dollars can be saved annually by not stripping, and they also lay no little stress on the value of carefully conducted plantation field tests as indispensable guides in the matter of such agricultural practices.

The first series of tests were started by Mr. R. E. Blouin on July 27th, 1901, and were harvested in April, 1903. The Lahaina variety was used in the experiments, and the plats were designated as follows:—

Plat No. 1.—No stripping.
,, ,, 2.—One stripping; June, 1902.
,, ,, 3.—Two strippings; March and October, 1902.
,, ,, 4.—Three strippings; March, August, and November, 1902.

From these tests the following results were obtained:—

WEIGHT OF CANE PER ACRE.

Number of Strippings	Weight of Cane per Acre. Lbs.
No stripping	150,950
One ,,	156,467
Two strippings	142,586
Three ,,	140,031

ANALYSIS OF JUICES.

Number of Strippings.	Brix.	Sucrose.	Purity.	Glucose.
No stripping	20·62	19·15	92·87	·311
One ,,	20·78	19·00	91·43	·258
Two strippings	21·18	19·50	92·06	·241
Three ,,	19·82	18·15	91·57	·369

YIELD OF SUGAR PER ACRE.

Number of Strippings.	Cane per Acre. Lbs.	Sucrose in Cane. Per cent.	Sugar per Acre. Lbs.
No stripping	150,950	17·14	25,873
One ,,	156,467	17·00	26,559
Two strippings	142,586	17·45	24,881
Three ,,	140,031	16·24	22,741

PERCENTAGE OF GAIN OR LOSS FROM STRIPPING.

Number of Strippings.	Tons of Cane.	Gain or Loss. Cane as Basis.	Tons of Sugar.	Gain or Loss. Sugar as Basis.
No stripping	75·48	—	12·94	—
One ,,	78·23	+3·5	13·30	+ 2·8
Two strippings	71·29	−5·6	12·44	− 3·9
Three ,,	70·02	−7·2	11·37	−12·1

The highest percentage of sucrose in the juice was obtained on the plat which had been stripped twice, although one stripping gave a slightly lower percentage of sucrose than was found in the juice of the unstripped plat. The cane which was stripped three times contained the smallest amount of sucrose in its juice, there being one per cent. less than was found in the case of the unstripped plat. The highest purity was found in the juice of the cane which had not been stripped.

Taking the unstripped plat as a basis, one stripping gave a gain of 3·5 per cent. on the weight of the cane and 2·8 per cent. on the weight of sugar. Two strippings gave a loss in cane of 5·6 per cent. and a loss in sugar amounting to 3·9 per cent. Three strippings decreased the cane yield by 7·2 per cent. and the sugar by 12·1 per cent. These plats were treated identically alike except with respect to stripping.

The second series was started in June, 1904, on land which had been rested for one year and which had been manured during that time with one crop of Mauritius beans. The experiment comprised fourteen plats of four rows, each row being 50 feet in length. The two middle rows of each plat formed the bases of the comparisons; one of these test rows was left unstripped and the other was stripped three times as follows: 1st stripping, January 25th, 1905; 2nd stripping, June 2nd, 1905; 3rd stripping, November 1st, 1905. With the exception of Plat No. 1, which was not fertilized, all of the cane in these tests received the same mixed fertilizer at the rate of 1000 pounds to the acre. The composition of the mixed fertilizer was as follows: 4 % phosphoric acid, soluble in water; 12 % potash, as sulphate of potash; 9 % nitrogen, as sulphate of ammonia.

The times of applying all fertilizers, and the manner in which the total quantity of the mixed fertilizer was divided for the several applications, were:—

Plat No. 1.—No fertilizer.
,, ,, 2.—One application with seed, 1904.
,, ,, 3.—One application in August, 1904.
,, ,, 4.—One application in April, 1905.
,, ,, 5.—One application in August, 1904; 300 lbs. of nitrate of soda in May, 1905.
,, ,, 6.—Two applications; with seed $\frac{1}{3}$, April $\frac{2}{3}$.
,, ,, 7.—Two applications; August $\frac{1}{3}$, April $\frac{2}{3}$.
,, ,, 8.—Two applications; August $\frac{1}{2}$, April $\frac{1}{2}$.
,, ,, 9.—Two applications; August $\frac{2}{3}$, April $\frac{1}{3}$.
,, ,, 10.—Two applications; August $\frac{2}{3}$, April $\frac{1}{3}$, 300 lbs. nitrate of soda in June.
,, ,, 11.—Three applications; August $\frac{1}{3}$, March $\frac{1}{3}$, May $\frac{1}{3}$.
,, ,, 12.—Three applications; August $\frac{1}{3}$, March $\frac{1}{3}$, May $\frac{1}{3}$, 300 lbs. of nitrate of soda in July.

Plat No. 13.—Three applications; August ⅓, March ⅓, May ⅓, 150 lbs. nitrate in September, 1904, 150 lbs. nitrate in July, 1905.

,, ,, 14.—Three applications; August ⅓, March ⅓, May ⅓, nitrate of soda, 100 lbs. per application in June, July, and August.

The average results yielded by these tests were as follows:—

DENSITY, SUCROSE, AND PURITY OF JUICE.

Plat.	Brix. Stripped.	Brix. Not Stripped.	Sucrose. Stripped.	Sucrose. Not Stripped.	Purity. Stripped.	Purity. Not Stripped.
Average	18·84	19·68	16·84	17·78	89·34	90·31

GLUCOSE AND GUMS OF JUICE, AND FIBRE PER CENT. CANE.

Plat.	Glucose. Stripped.	Glucose. Not Stripped.	Gums. Stripped.	Gums. Not Stripped.	Fibre per cent. Cane. Stripped.	Fibre per cent. Cane. Not Stripped.
Average	·49	·42	·38	·43	10·8	11·1

WEIGHT OF CANE AND SUGAR PER ACRE. LBS.

Plat.	Cane per Acre. Lbs. Stripped.	Cane per Acre. Lbs. Not Stripped.	Sucrose in Cane. Stripped.	Sucrose in Cane. Not Stripped.	Sugar per Acre. Lbs. Stripped.	Sugar per Acre. Lbs. Not Stripped.
Average	152,937	201,558	15·02	15·81	23,086	31,831

WEIGHT OF CANE AND SUGAR PER ACRE. TONS.

Plat.	Weight of Cane. Tons. Stripped.	Weight of Cane. Tons. Not Stripped.	Weight of Sugar. Tons. Stripped.	Weight of Sugar. Tons. Not Stripped.
Average	76·47	100·78	11·54	15·92

NUMBER OF DEAD CANES PER ACRE.

Plat No.	Stripped.	Not Stripped.	Plat No.	Stripped.	Not Stripped.
1	2788	4530	9	6098	3659
2	5401	4879	10	7841	3833
3	5750	2614	11	6447	5227
4	5053	2265	12	5924	3659
5	9060	3485	13	9235	4879
6	5227	2439	14	8189	3136
7	8886	7144			
8	5227	3833	Average	6509	3970

On reviewing the data presented in the foregoing, a number of interesting facts are disclosed:—

1.—The richest juice was contained in the unfertilized cane.

2.—In each of the fourteen plats the percentage of sucrose was higher in the juice of the unstripped cane than in the juice of the stripped cane.

3.—The average density, sucrose, and purity figures were considerably higher for the juice of the unstripped cane.

4.—The average percentage of glucose in the juice of the unstripped cane was lower than that of the juice of the stripped cane.

5.—The average content of gums was higher in the juice of the unstripped cane.

6.—The average percentage of fibre was slightly higher in the unstripped cane.

7,—The sucrose per cent. cane was 0·8 per cent. greater in the unstripped than in the stripped cane.

8.—The unfertilized unstripped cane yielded 2·79 tons of cane and 0·66 tons of sugar less to the acre than the unfertilized stripped cane.

9.—The average weight per acre of unstripped cane was 24·31 tons more than that of the stripped cane, and the yield of sugar was 4·38 tons greater.

10.—In all of the fertilized plats the yield of stripped cane was less than where no fertilizer had been applied. The largest loss from fertilization was 31·1 per cent.

11.—With the unstripped cane, twelve plats out of thirteen showed a gain in weight of cane from fertilization. The largest increase amounted to 24 per cent. One plat (No. 2), gave a loss of 2·4 per cent.

12.—The largest loss in weight of cane on the fertilized plats due to stripping was 44 per cent., and the smallest loss 14·5 per cent.

13.—In all of the fertilized plats, the yield of sugar in the stripped cane was less than where no fertilizer had been applied. The largest loss from fertilization was 45·7 per cent., and the smallest loss 11·1 per cent.

14.—In the case of the unstripped cane seven out of the thirteen fertilized plats gave an increased yield of sugar. The greatest gain was 16·7 per cent., and the largest loss 7 per cent.

15.—The largest loss in yields of sugar (from stripping) on the fertilized plats was 49·8 per cent., and the smallest loss 18·6 per cent.

16.—A smaller number of dead canes was found in the stripped cane of the unfertilized plat than in the unstripped cane.

17.—In each of the thirteen fertilized plats, there were more dead canes among the stripped than among the unstripped cane.

18.—There were 2539 more dead canes (on an average) to the acre among the stripped cane than among the unstripped cane.

(To be continued.)

CONSULAR REPORTS.

Uruguay.

In the month of April of the present year (1906) a Bill providing for a bounty on sugar was passed by the Chambers, the substance of which is as follows :—

Art. 1.—Hereby is granted to the plantation of beetroot, and the production of native sugar, a bounty under the following conditions :—

Art. 2.—The said bounty shall be $50,000 in the first year, $40,000 in the second, $30,000 in the third, and $20,000 in the fourth and fifth, after which it shall cease.

Art. 3.—Those desiring to obtain these bounties must produce 300,000 kilos. of sugar in the first year, 400,000 kilos. in the second, 600,000 kilos. in the third, 1,100,000 kilos. in the fourth and 1,500,000 kilos. in the fifth, save in duly justified cases of *force majeure* admitted by the Executive. They are also obliged to cultivate from the first year 300 hectares of beetroot.

Art. 4.—The cultivators of beetroot, and manufacturers of native sugar, claiming these bounties, may discount them in advance. (Here follow details which may be omitted in this report, as they do not affect the principle of the Bill.)

Art. 5.—Raw sugar imported for refining shall pay duties with the discount of a margin (merma) of 6 per cent. on the net weight of the same.

Art. 6.—Until the end of the year 1915 there shall prevail a difference in favour of the native product of not less than $0·067 per kilo. of unrefined sugar and $0·078 per kilo. of refined sugar between the total taxes paid respectively by the native and the imported article.

Art. 7.—The benefits of this Act shall only be enjoyed by those who within the first two years (1906-07) fulfil the stipulations of Art. 3 by manufacturing 300,000 or 400,000 kilos. of sugar.

Art. 8.—The seeds of saccharine plants, coal and machinery intended for sugar factories shall be exempted from import duty under the usual conditions of control.

It may here be mentioned that the import duty on the actual value of sugar amounts to 120 to 130 per cent.

Philippine Islands.

Raw sugar valued at £1,015,374, an increase of £396,827 over that of 1904, was exported from the Philippine islands during the year 1905. This increase is attributable largely to the rise in price of sugar, the excess in weight being 21,000 tons.

Shipments were made to the following countries:—

Country.	Value. £
United States	420,404
Hong-Kong	392,005
China	156,355
Japan	42,448
United Kingdom	4,162
Total	£1,015,374

PUBLICATIONS RECEIVED.

Beet Sugar Manufacture. By H. Claassen, Ph.D. Translated from the German ("Die Zuckerfabrikation," second edition) by Wm. T. Hall, B.Sc., and George William Rolfe, M.A. 8vo., xiv + 280 pages. Cloth, 12/6 net. London, Chapman & Hall; New York, John Wiley & Sons.

When Dr. H. Claassen's great work on Beet Sugar Manufacture appeared in Germany a few years ago, there was natural regret evinced that to the majority of English-speaking beet sugar manufacturers it was inaccessible for ready reference, owing to its being in German. It is consequently a matter for congratulation that two American professors have undertaken the preparation of an authorized English translation, which they have just lately issued to the public. There are 28 chapters, as well as some tables; and to enable our readers who have not seen the German original to get some idea of the contents, we give herewith the titles of the chapters.

I., The Delivery, Receiving, and Storage of Beet; II., Transporting and Washing the Beets; III., Weighing and Slicing Beets; IV., Diffusion; V., The Exhausted Chips; VI., The Preliminary Purification and Warming of the Diffusion Juice; VII., Defecation; VIII., Carbonatation; IX., Treatment of the Sludge or Scums; X., Final Carbonatation and Filtration; XI., Other Purifying and Clarifying Agents; XII., Evaporation; XIII., The Condensation of the Evaporation Vapours; XIV., Carbonation and Filtration of the Concentrated Juice or Syrup; XV., Sugar Boiling; XVI., Working up the Massecuite; XVII., The Centrifugal Work; XVIII., Raw Sugar and its Preparation; XIX., The Preparation of Sugar Crystals; XX., Working up Centrifugal Sugar into After-Products; XXI., The Purification of Centrifugal Syrup; XXII., Molasses and its Utilization; XXIII., The Boiler House; XXIV., The Lime Kilns; XXV., Heat Losses during the Process; XXVI., Factory Control and Determination of Sugar Losses; XXVII., General Suggestions concerning the Fitting-up and Running of a Beet Sugar Factory; and XXVIII., The Utilization and Disposal of the Waste Products and Sweet Waters.

This is clearly a work that should be in the library of every beet sugar man who desires to master the scientific side of his industry. It should be noted that all the principal data of factory practice have been given in those units which are in every-day use in American if not also in British sugar houses, so that no time will be lost through having to resolve the figures from one set of units into another. Finally the price of the work should bring it within the reach of all, as the publishers have wisely brought it down to a figure below that of the German volume.

Ausführliches Handbuch der Zuckerfabrikation (Comprehensive Handbook of Sugar Manufacture). By Dr. A. Rümpler. Braunschweig, Germany, Verlag von F. Vieweg & Sohn. Quarto, 790 pp. with 368 illustrations and two tables. Mks. 18, bound in cloth.

One of the invaluable German technical works which appear from time to time. Its contents originally formed the section on "Sugar" in Muspratt's *Encyclopædic Handbook of Technical Chemistry*, but several new chapters have been added, including one on the history of the industry. Although mainly dealing with the beet sugar practice in vogue abroad, cane sugar is not altogether ignored. The copious illustrations of machinery and apparatus are alone well worth the cost of the book.

Correspondence.

THE HINTON-NAUDET PROCESS.

To the Editor of "The International Sugar Journal."

Sir,—With reference to Mr. Nursey's paper on cane sugar machinery, as reported in your November issue, I see that you observe, with respect to the Hinton-Naudet process, that "it is highly desirable that more complete data should be forthcoming and signed by two or more impartial authorities." I am entirely of your opinion. As it was in my sugar factory that this process was first tried, perfected and patented for cane, anything I say or write on the subject will naturally not be considered impartial.

But I should be glad to submit the following plain facts to your readers, viz., that whereas, before taking up the process, I used quadruple crushing, that is, four mills of three rollers each, with maceration between each mill, now with the diffusion battery I obtain more than 10% more sugar than I did with quadruple crushing.

With this process, the cane juice from mills is defecated and filtered in its own megass, and goes straight to the triple, and as a practical manufacturer for the last 30 years, I maintain that the mere fact of the complete disappearance of all clarifiers, eliminators, and filter presses, with their endless train of acid-breeding skimmings, is quite sufficient proof (to say nothing of the much higher yield in sugar) that the diffusion of the megass by forced circulation is the only rational means of manufacturing cane sugar.

When the process was first introduced, one of the main objections brought against it, was that as all, or nearly all the sugar was extracted from the megass, the latter would in proportion not be as useful a fuel. Arguments such as these are beneath consideration.

In conclusion, I can only repeat what I have told all the sugar planters I have met in London, that Madeira is but 3½ days from Southampton, that my crushing season begins the first week in March and lasts three months, and that I should be extremely pleased to show any of them the whole process at work and the results obtained.

Yours faithfully,

HARRY C. HINTON.

Madeira,
1st December, 1906.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. THOMPSON, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—APPLICATIONS.

25340. J. J. EASTICK, London. *Process for making and purifying invert sugar.* 10th November, 1906.

25860. J. OST, London. *Improved process of sugar purification and means or apparatus therefor.* 15th November, 1906.

26871. E. T. NEWTON-CLARE, London. *Improvements in and apparatus for the manufacture of sugar.* 26th November, 1906.

GERMAN.—ABRIDGMENT.

175760. PAUL RASSMUS, of Magdeburg. *A press for beetroot shreddings and the like with means for introducing air.* 20th March, 1906. This beetroot shreddings press is characterized by its being provided with an arrangement for the introduction of compressed air or a compressed gas into the space surrounding the sieve casing, in such a way that the air or gas may penetrate from here into the interior of the sieve cylinder.

NOTE.—Copies of all published specifications with their drawings in these lists can be obtained from W. P. Thompson & Co., 6, Lord Street, Liverpool, at One Shilling a copy for English or American Patents, and Two Shillings for German. In ordering please give number and date.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of November, 1905 and 1906.

IMPORTS.

Raw Sugars.	Quantities. 1905. Cwts.	Quantities. 1906. Cwts.	Values. 1905. £	Values. 1906. £
Germany	4,914,267	7,869,233	2,709,561	3,432,194
Holland	194,547	513,565	109,806	242,047
Belgium	848,933	1,220,400	467,428	555,942
France	676,005	248,563	357,147	109,435
Austria-Hungary	380,585	191,519	247,906	78,707
Java	2,377,981	304,996	1,515,695	146,522
Philippine Islands	9,023	....	4,840	....
Cuba	....	111,910	....	41,943
Peru	1,113,642	523,829	711,843	236,713
Brazil	126,494	975,768	62,486	382,779
Argentine Republic	....	....	....	....
Mauritius	167,007	127,205	91,001	48,362
British East Indies	256,180	146,188	143,662	60,570
Straits Settlements	193,126	92,813	102,945	36,959
Br. W. Indies, Guiana, &c.	1,066,066	1,534,709	830,243	818,211
Other Countries	761,276	190,317	507,013	88,594
Total Raw Sugars	13,085,132	14,051,015	7,861,576	6,278,978
Refined Sugars.				
Germany	8,723,676	11,054,398	6,702,214	6,322,530
Holland	1,610,969	2,571,621	1,257,802	1,560,514
Belgium	289,194	508,417	217,057	298,653
France	2,235,149	2,215,702	1,556,250	1,256,600
Other Countries	345,778	3,855	283,604	2,251
Total Refined Sugars	13,204,766	16,353,993	10,016,927	9,440,548
Molasses	2,386,778	2,534,845	471,096	489,846
Total Imports	28,676,676	32,939,853	18,349,599	16,209,372

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	1,053	263	500	175
Norway	19,526	16,731	14,276	9,961
Denmark	81,839	90,153	55,656	45,513
Holland	77,717	73,965	58,037	45,588
Belgium	9,345	10,245	5,807	5,984
Portugal, Azores, &c.	15,973	28,556	10,937	15,586
Italy	15,388	32,584	9,131	16,472
Other Countries	354,474	601,133	292,207	393,537
	575,315	853,630	446,551	532,816
Foreign & Colonial Sugars				
Refined and Candy	22,412	32,120	19,097	20,288
Unrefined	95,616	158,659	64,087	81,190
Molasses	2,763	5,548	848	1,784
Total Exports	696,106	1,049,957	530,583	636,078

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1906. Tons.		1905. Tons.
Total Receipts Jan. 1st to Dec. 20th ..	1,894,176	..	1,850,939
Receipts of Refined ,, ,, ...	1,905	..	1,533
Deliveries ,, ,, ...	1,952,637	..	1,781,139
Consumption (4 Ports, Exports deducted) since January 1st..	1,940,460	..	1,747,650
Importers' Stocks, December 19th.. ..	None	..	69,800
Total Stocks, December 19th	135,000	..	176,230
Stocks in Cuba, ,, ...	9,000	..	37,000
	1905.		1904.
Total Consumption for twelve months ..	2,632,216	..	2,767,162

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1905 AND 1906.

(Tons of 2,240lbs.)	1904-05. Tons.		1905-06. Tons.
Exports	1,044,430	..	1,150,466
Stocks	73,668	..	903
	1,118,098	..	1,151,369
Local Consumption (twelve months)..	45,160	..	46,830
	1,163,258	..	1,198,199
Stock on 1st January (old crop)	——	..	19,450
Total Receipts	1,163,258	..	1,178,749

Havana, November 30th, 1906. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR ELEVEN MONTHS ENDING NOVEMBER 30TH.

SUGAR.	Imports. 1904. Tons.	Imports. 1905. Tons.	Imports. 1906. Tons.	Exports (Foreign). 1904. Tons.	Exports (Foreign). 1905. Tons.	Exports (Foreign). 1906. Tons.
Refined	792,905	660,238	817,700	1,138	1,121	1,606
Raw	684,997	654,256	702,551	4,848	4,781	7,933
Molasses	85,034	119,339	126,742	116	138	277
Total..........	1,562,936	1,433,833	1,646,993	6,102	6,040	9,816

	Home Consumption. 1904. Tons.		Home Consumption. 1905. Tons.		Home Consumption. 1906. Tons.
Refined	800,643	..	660,098	..	796,349
Refined (in Bond) in the United Kingdom	490,854	..	512,337	..	499,681
Raw	114,596	..	94,211	..	109,558
Molasses	78,491	..	111,890	..	121,898
Molasses, manufactured (in Bond) in U.K.	55,944	..	51,758	..	57,004
Total	1,540,528	..	1,430,294	..	1,584,490
Less Exports of British Refined.....................	27,467	..	28,766	..	42,681
Total Home Consumption of Sugar	1,513,061	..	1,401,528	..	1,541,809

Stocks of Sugar in Europe at uneven dates, Dec. 1st to 15th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1906.
129	1187	796	708	229	3049

	1905.	1904.	1903.	1902.
Totals	3083 ..	2711 ..	3297 ..	3062

Twelve Months' Consumption of Sugar in Europe for Three Years, ending November 30th, in thousands of tons.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1905-06.	Total 1904-05.	Total 1903-04.
1838	1196	643	544	197	4419	3755	4210

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.	1903-1904. Tons.
Germany	2,200,000	2,415,136	1,598,164	1,927,681
Austria	1,375,000	1,509,870	889,373	1,167,959
France	750,000	1,089,684	622,422	804,308
Russia	1,450,000	988,000	953,626	1,206,907
Belgium	275,000	328,770	176,466	209,811
Holland	190,000	207,189	136,551	123,551
Other Countries	430,000	415,000	332,098	441,116
	6,670,000	6,953,649	4,708,758	5,881,333

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NOTES AND COMMENTS.

The Kingston Earthquake.

The appalling catastrophe which overwhelmed Kingston, Jamaica, on the 14th January, comes as a terrible blow to that colony. As our readers will be aware, an earthquake of unusual duration and severity took place in the afternoon of that day and as a result practically the whole of Kingston was destroyed, what the earthquake spared being ravaged by the ensuing fire. At the very time of the shocks, the Agricultural Conference was sitting, but most providentially the building in which the meetings were being held did not collapse or we might now be mourning the loss of all the leading lights in the planting world out in the West Indies. As it is, the loss of life, great as it has been, has not with a few exceptions included any prominent persons, at any rate as far as present information goes. But among the twelve or fifteen hundred killed was Sir James Fergusson, who was on a health visit to the island. He was crushed under a falling pile of masonry. Sir Alfred Jones had a marvellous escape, but came out scot free. As to Kingston itself, it has been pointed out that nature has now demolished a town which in some parts at least should have been demolished long ago. Its slums were said to be in a disgraceful condition. That the town will be rebuilt seems probable, though the ground on which it rests is declared to be the worst possible for withstanding earthquake shocks, being mainly sand and

gravel. As to the effects of this catastrophe on the Jamaicans, it is early to express an opinion, but it may be observed that Jamaica's industries lie in the country and those have not been affected.

Sugar Company Meetings.

The New Colonial Company have had an unprofitable year, as far as their sugar estates are concerned. These have resulted in a loss of £35,161. But against that there is to be set a profit of £22,913 made on their general profit and agency business, which really came out of the estates. The causes of this unsatisfactory state of affairs as given at the annual meeting were ascribed to low prices of sugar and rum, and increased expenditure, which included a special outlay on the Windsor Forest Estate. A shareholder remarked that having regard to the fact that the company's estates were known to be very good ones, the accounts were very disappointing. He believed their misfortunes to be due to two causes, undercultivation and unsatisfactory methods of extracting the sugar. This drew from Sir Nevile Lubbock the statement that to erect new mills on the estates would cost £30,000 each, and they had nine estates.

The Natal Estates Limited has had to be content this time with a dividend of 8% as compared with one of 10%, such as the last few years have yielded. A drought and a drop in sugar prices accounted for £13,000. Again, the new South African Customs Convention as regards sugar had had an adverse effect, as they had not been able to compete successfully with the imports of German beet sugar. At present beet sugar entered the colonies at the same rate as unrefined sugar; but the managing director of the Company in Natal believes this arrangement will be altered in due course to the Company's benefit.

Cuban Affairs.

The status of Cuba still remains unsettled. But it seems clear that she cannot be allowed to go on in the old way. Two alternatives seem feasible—annexation by the United States, or the formation of a protectorate under the same power. The former would mean free trade between Cuba and the States,—and a Dingley tariff for all other trading interests. Such a status would be welcomed chiefly by those Americans who have large financial interests in the island. And that America's financial hold on Cuba is no light one is manifest when we learn from an American contemporary that her interests in Cuba are valued at not less than $159,500,000 (of which sugar and tobacco account for 30 millions each). But apart from such interests, Cuba, generally, does not seem over-anxious for annexation, and in the United States there is plenty of opinion against the proposal. The opposition of the home beet and cane sugar manufacturers goes

without saying; but over them there exists a feeling that the United States are getting large enough for one central authority to control. If Washington cannot make California respect an international treaty, it is surely idle on her part to desire to add to her labours the absolute control of a cosmopolitan race living at a considerable distance from the seat of government. Neither do Americans view with equanimity the prospect of the admittance on an equal footing into the Union of the various caste and half-caste races which go to form the population of Cuba. Race prejudice is still strong in the States.

On the other hand there is a proposal for a protectorate, a movement in favour of which appears to be rapidly gaining ground. Most of the Cuban newspapers are said to have pronounced in its favour. It would imply more than the present Platt régime. An official of the United States Government would supervise everything; but the Cubans would be allowed to have the Republican form of Government, their own officials, and their institutions. This might save the national pride, while ensuring peace and commercial security; but we fear that the alteration of the tariff so as to suit both the American speculators and the native Cuban interests will prove a thorny question to settle, and other countries will here have something to say. As for British interests, their protection is limited to the bandying about of high sounding phrases, such as "most-favoured-nation treaty," etc., which impress no one outside the United Kingdom, mean nothing in practice, and are as powerless to save as is an empty revolver. Nevertheless, we anticipate that the outlook for British trade (under our present fiscal system) will not be so bad in the case of a Cuban Protectorate as in that of an annexed Cuba. But that it is bad enough anyhow, a few enquiries in Glasgow would soon demonstrate.

Test for Cane Sugar in Milk Sugar.

Mr. Henry Leffmann, in the *Journal of the Franklyn Institute*, mentions that he has found that the reaction with sesame oil and hydrochloric acid is a satisfactory test for sucrose in lactose, being better than carbonization with sulphuric acid. The test is applied by mixing about 1 cc. each of sesame oil and strong hydrochloric acid, adding about 0·5 gram of the same to be tested, shaking actively for a few moments and then allowing the liquid to stand for thirty minutes. As little as one per cent. of sucrose can be detected, but for such quantity it may be necessary to allow the liquid to stand for a longer time. Sucrose can be easily detected in milk-products, and the test will be applicable to the detection of the comparatively new "cream-thickener" consisting of calcium oxide and sucrose. Mr. Leffmann is studying the applicability of the test to other carbohydrate mixtures.

The Yield of the Sugar Tax.

The yield of the Sugar Tax in the United Kingdom since its inception has been:—

	1901-2.	1902-3.	1903-4.	1904-5.	1905-6.
	£	£	£	£	£
Gross Receipts less repaypayments	6,578,780 ..	4,780,976 ..	5,971,639 ..	6,214,164 ..	6,293,105
Drawbacks	179,552 ..	302,269 ..	245,726 ..	107,777 ..	115,152
Net Revenue	6,399,228 ..	4,478,707 ..	5,725,913 ..	6,106,387 ..	6,177,953

Naturally the "sugar users" lament over the fact that this total of nearly £29,000,000 has involved a tax per head of 13s. 9d. to date. But we fail to see any hardship having regard to our existing very limited sources of taxation. When we have a finance minister with more progressive ideas than Mr. Asquith, or rather his party, possesses, it will be time enough to think of shifting this "burden" to other shoulders.

DENOUNCING THE BRUSSELS CONVENTION.

It is easy for irresponsible party politicians to assume as a matter of course that such an iniquitous measure as the Sugar Convention will quickly get its quietus at the hands of an intelligent Government, but it by no means follows that the Government, if really intelligent, will take any hasty step without giving the matter some reasonable consideration. It is therefore very desirable that a few useful helps towards an intelligent understanding of the position should be, from time to time, offered for the consideration of the Departments responsible for this vital decision.

We say vital because on this decision depends the fate of many interests; interests of the sugar industries of our colonies and of our refiners; interests of the consumer—even of the confectioner; and, last but not least, the interests of the Government and of freedom of trade and industry, all depend on the right handling of this important question. Some may say that sugar is a very minor consideration in these days of burning questions. Yes, but this is a much bigger question than the fate of the sugar industries. A little consideration will prove this.

Let us suppose that the Government, in its wisdom, denounces the Convention. What will be the first result? Germany and Austria at once revert, automatically, to the high surtax on imported sugar; this immediately revives the dormant Cartels, prices in the home markets of those countries are again raised almost to the level of the high import duties, and once more an enormous extra profit to producer and refiner is the result. This abnormal profit must inevitably bring with it, as before, a great increase in production; not a natural and healthy increase but an artificial and injurious one. "Glut, collapse and ruin" will once more dominate the sugar markets of the world.

The confectioners, who presume to be the expert advisers of the present Government, tell them that this is the very result for which they have been clamouring. Cheap sugar they already enjoy, but what they want and what they insist on having is sugar ruinously cheap, such as they had in 1901-2, when prices went down 3s. per cwt. below the cost of production. Very well, they will get this and will have to take the consequences. They have plenty of high class political economists on their side, men who have no practical experience in the world of industry and commerce, who declare, like the confectioners, that the only object of what they erroneously call free trade is cheapness, never mind how produced, never mind how temporary or how quickly followed by "glut, collapse, and ruin."

But what about the result to the Government? They will have pacified the confectioners, but will the colonies take it lying down? And when the "glut" has been followed by "collapse and ruin," when the natural production of sugar has been checked or stopped by the overproduction in Germany and Austria and prices have gone up to double what they are in these days of normal cheapness, how will the Government defend themselves against the attacks of tariff reformers who will point to these as the inevitable and fatal results of allowing heavily protected foreign producers to smash markets by means of their Cartel bounties and thus get for themselves a monopoly of the industries?

These are not dreams, but hard facts. The leaders of the German sugar industry deliberately and openly contemplated this result five years ago, when their big Cartel bounties had made them increase production by leaps and bounds. "Low prices," they said, "are what we must aim at in order to drive out our competitors." Our Government is going to help them to do this again. They are waiting and watching anxiously. It is England, they say, that must denounce the Convention; it cannot be done without her help. If that help comes they look forward to a good time for the German sugar industry.

The Germans now express their surprise that the Convention did not cause, as one of its results, a reduction in exports. They find to their joy that the exports were larger than ever. It is curious to study the many wild ideas that have prevailed with regard to the probable—or even certain—results of the Convention. The Cobden Club told us, and every confectioner repeated it, followed by all the leading radical statesmen in both Houses of Parliament, that as the bounties amounted to £5 a ton it was quite manifest that when they were abolished prices would rise £5 a ton, which would make a difference to the consumer of exactly 1,600,000 tons multiplied by £5, that is, £8,000,000 a year. No such result occurred; on the contrary prices went down until, unfortunately, a severe drought reduced the production by 1,200,000 tons. That was pretended to

help the argument for a time, but a big crop next season brought prices down with a run well below the cost of production. The Cobden Club, the confectioners, and the radical statesmen were quite ignorant of the fact that the only effect of bounties is to cause over-production, resulting eventually in "glut, collapse and ruin." Bounties have now been abolished, but that is no reason why Germany should not continue to enjoy a good export trade.

The German sugar industry will be in a better position than ever to dominate the sugar markets of the world if we denounce the Convention. France has now abolished her bounties, reduced her duties, and nearly doubled her consumption. She is not likely to start the bounty system again, and she cannot imitate Germany and Austria by starting a Cartel because it is against the law. Here is a good chance for Germany to kill the French sugar industry as far as exports are concerned, and she will no doubt do her best. France will not be altogether grateful to us for this result of our hasty denunciation of the Convention.

In 1900 we had a very important Congress of the Chambers of Commerce of the Empire, at which a strong resolution was passed by a very large majority, calling upon the Government to negotiate for the abolition of the sugar bounties, on the basis of giving a security to the Contracting Powers that they shall no longer have to contend with bounty-fed competition on British markets. That was a mandate and it was acted upon. What will the next Colonial Congress say if our Government wantonly destroys the policy so successfully demanded? As to some of our sugar colonies in the West, they know well that their transfer to the United States would bring them prosperity and a brilliant future. They remain loyal to the mother country, they have struggled long against the injustice of bounty-fed competition, and at last they have had a fair field of equal competition restored to them. If this is to be wantonly snatched away from them again, to please the erroneous views of misguided economists and to pacify the savage onslaught of party vindictiveness, our western colonists may begin to feel that even patriotism has its limits.

But let us turn to the so-called arguments of the economists, which, however ridiculous they may appear to those who know the facts, have undoubtedly succeeded in misleading the general public and the radical statesmen.

It was impossible to negotiate a treaty for the abolition of bounties without giving the Contracting Parties security that bounties should no longer be permitted to disturb the natural course of trade and industry. The Contracting Powers demanded, and have demanded for more than thirty years of negotiations, that if they abolished their bounties any remaining existing bounty should, as security to

them, be countervailed by an equivalent duty. This was not only reasonable and sound but absolutely necessary. A bounty on produce imported free into this country is protection to foreign producers in British markets. To countervail it is to restore the freedom of competition which the bounty had destroyed. But, unfortunately, those free traders who erroneously believe that Free Trade means "duty for revenue purposes only" would not listen to the words "countervailing duty." They wanted to abolish the bounties and to give the necessary security, but, they said, let it be "prohibition," not a countervailing duty. The substitution was absurd, but to please the so-called free trader it was accepted, and now the outcry is that Russian sugar is shut out and that prices are therefore raised. That is the only practical objection urged against the Convention, and it has no foundation in fact. The reason why it has no foundation is very simple and obvious, but the opponents of the Convention refuse to see it; from which we must infer either that they are very blind or that their only object is to oppose. The latter was a very good policy as long as they were in opposition. Then their only object was to vilify the Government and get them out. But now, the policy of wilfully misleading their own Ministers is not so easy to explain.

The reason why prohibition of bounty-fed Russian sugar has no effect on the price of sugar in this country is that our price is always the world's price. Hamburg quotations are our quotations. If Russia makes too much sugar and throws her surplus on the world's markets, that, so far as it goes, helps to depress prices, and we at once get the benefit of that depression just as much as if the Russian sugar came here. Wherever it goes it displaces an equal quantity of German or Austrian sugar which can come to us instead. That is a very simple explanation of the facts and is absolutely indisputable. But still the same old cry goes on and misleads not only the public but the Government. When the announcement is made that the Government have decided to denounce the Convention it will no doubt take a front place in their list of reasons.

Then will come the tug of war. The arguments of the Government will not hold water, their political economy will break down, and the country will begin to see that at all events some of the tariff reformers have reason and common sense on their side. The sugar industries will suffer, but the cause of free competition will gain fresh force and new sinews of war. Out of evil good will come and fresh light will be furnished to expose the miserable fallacy that Free Trade means "duty for revenue purposes only."

GERMANY AND THE BRUSSELS CONVENTION.

As it is instructive to learn what views are held amongst German sugar manufacturers regarding the Brussels Convention, the follow- extracts from recent issues of the *Deutsche Zuckerindustrie* will be found of interest.

"An announcement which, should the same be confirmed, would prove very important, has been received from Antwerp by the London *Tribune*, on the 22nd of November. This announcement states, in accordance with the 'Circulaire hebdomadaire du Syndicat des Fabricants de Sucre de France,'

"In view of the notice of termination of the Brussels Convention on the part of Great Britain, negotiations have been begun between the other high contracting parties with the view of maintaining the agreement, according to Article 10 of the Convention of March, 1902."

"In order to perceive the full scope and meaning of this announcement, it is necessary to understand the legal aspect of the case as regards prolongation or non-prolongation of the Brussels Convention. Article 10 of the Brussels Convention reads as follows:—*(Here followed Article 10 of Brussels Convention.*)*

"These decisions give rise to a number of possibilities. 1. Notice of termination of the Convention will not be given by any of the contracting States up to the 1st of September, 1907. It therefore continues in force another year from the 1st of September, 1908, and if no notice of termination be given by any one before the 1st of September, 1908, for one year more, and so on.

"2. One of the contracting States intends to withdraw itself from the effects of the Convention. This State would therefore have to give notice at latest up to the 31st of August, 1907 or 1908. The effects of this notice differ according as (*a*) the particular State is alone in giving notice of termination. In this case the notice is effectual in regard to that State alone. The Convention remains in force for the other States, unless (*b*) one of the other States (such as Peru, which after the eventual secession of Great Britain would hardly have any interest in belonging to the contracting States) gives notice at the same time or makes use of its right up to the 31st of October of the year of notification, to declare that from the 1st of September of the succeeding year, it also desires to withdraw. Should such a case arise, the Belgian Government has to bring about a Conference in Brussels within three months, which will decide about the steps to be taken.

"The fact of one or two Convention States giving notice of termination does not therefore entail the cessation of the Brussels agreement. Even in case two States withdraw, the Convention is not to be

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* See *I.S.J.*, 1902, p. 176.

declared at an end, but a decision must be arrived at in Conference as to the 'steps to be taken.' This decision need not necessarily lead in all cases to the termination of the Brussels Convention. The withdrawal of, say, Luxemburg and Switzerland from the ranks of the contracting States might very well be imagined, without rendering the prolongation of the Brussels Convention impossible. It would however be another matter if Great Britain, the prime mover in bringing about the Convention, were to withdraw. With the disappearance of this country from the number of contracting States, the position of the mid-European Convention States would be so much affected that they would have every reason for asking themselves seriously whether they would be prepared to continue the Convention without England.

"Naturally, the solution of this problem could only be arrived at with the assistance of the interested industries, as their weal or woe depends upon the settlement of this question. For this reason we cannot give unbounded credence to the above-named announcement of the London paper, that the contracting States have already begun negotiations with each other, irrespective of England, in regard to preserving the Convention, seeing that the interested industries have not yet been consulted. If there is any truth in the announcement, it is likely to be merely a question of the contracting States ascertaining each other's feelings in the matter, in order to see whether England will think of giving notice of termination of the agreement and whether in that case another State will follow suit.

"It is very important, in the interests of the whole sugar industry, that the position should be made clear. An authoritative pronouncement on the question would be most desirable."

* * * * * *

"The year 1907 opens with the query whether it is in the interest of the sugar industry that it should in future be bound by international agreement, and whether the Brussels Convention should be prolonged after the 1st of September, 1908, or not. The first effect of the Convention has been the abolishing of the bounties; but their re-introduction, if the Convention should cease, is so far removed from the range of possibility, as far as Germany is concerned, that it may safely be left unconsidered. The diminution of protection has, however, worked as effectively as the abolition of the bounties, and here it will have to be proved whether a resumption of the former status in this respect will tend to the advantage of the sugar industry as compared with present circumstances.

"In regard to the Convention itself, it will not be easy to arrive at a decisive judgment; for, as is often the case in social questions, apart from legal measures, such as commercial treaties, alterations of duty, &c., there are other influences at work which make it extremely difficult, if not impossible, to rightly apportion the different effects

which these legal measures should exercise. A year ago the working of the Convention might have been reduced to the following formula:—Reduction of exports, increase of home trade; but this formula cannot be held to at present, as the export outlet during the last campaign and also in the first months of the present season, has been larger than at almost any time previously. Whilst this development will not be explained detrimentally to the Convention, this does not mean that the Convention in its present form and scope should be prolonged; a short time since we have shown elsewhere that an alteration of the Convention in many important points is most desirable; but neither does it mean that the Convention can be upheld without England's participation.

"In any case, a number of most important questions will present themselves for solution during the next year in the United States and Canada, quite apart from the fact that our own commercial policy will find plenty of occasion for weighty legislation in regard to the sugar industry.

"That all these questions may be settled in a manner favourable to the sugar industry and that the year 1908 may begin under more favourable auspices, is our New Year's wish for 1907."

SUGAR REFINING IN GREENOCK, 1906.

The refining industry of Greenock did very well during 1906. The quantity of sugar worked up in the refineries was the largest since 1892, amounting to 188,000 tons, an increase of 44,000 tons over that of 1905. This is a better record than London, where the output was practically the same, or Liverpool which had an actual decrease. Out of seven refineries in this town, six were working fairly continuously. The seventh, the Clyde Refinery, has done no work, as it has been in the market for some time past. A public auction failed to find a purchaser for it, and the latest information is that a Glasgow firm have purchased the machinery.

The following, an extract from an article in the *Greenock Telegraph* on this subject, is worth reproducing as showing what has been the actual effect of the Brussels Convention on sugar prices.

* * * * * *

"1906 may be considered a normal year whereby to judge whether the prognostications of the opponents of the Brussels Convention have been justified or not. It will be remembered that they foretold that when the Convention took full effect the prices of sugar would be enormously enhanced, and the industries dependent on a cheap supply of that article wiped out of existence. A few figures will show the actual facts in regard to the prices

of sugar now under the Convention, compared with what was the position before the Convention. The average price of 'Neill's Tops' for 1906 has been 15s. 8d. duty paid, or, deducting 4s. 2d. duty, 11s. 6d. per cwt. short price. In 1896, ten years ago, when the bounties were in full swing and the confectionery trade supposed to be consequently extremely flourishing, the average price of 'Neill's Tops' was 13s. 10½d.; there was no duty then, and the only deduction required to be made from the quotation in order to make it accurately comparable with present prices is the 2½ per cent. discount which was then allowed, but which is now abolished. This amounted to about 4d. per cwt. on 13s. 10½d., leaving the net price 13s. 6½d. The price of the sugar is, therefore, fully 2s. per cwt. cheaper in 1906 than in 1896, which latter may be taken as a normal year before the imposition of the duty. The average price of 'Neill's Tops' was 12s. 6d. in that year, or, deducting 4d. for discount, the net price was 12s. 2d., or 8d. per cwt. over the price of 1906. There was indeed one year, 1902, after the imposition of the duty, but before the Convention took effect, when the price fell to an unprecedentedly low figure, viz., 13s. 7d., or, with 4s. 2d. duty off, 9s. 5d. short price. But this was altogether exceptional, and was brought about by abnormally large crops, and is no more to be taken into account in a general argument about prices than the abnormally high prices of other exceptional years. For instance, the price in 1905 was 18s. 7½d. duty paid, or 14s. 5½d. short price; but this was the result of a serious crop failure. Such abnormal years counterbalance one another, and show that the average price is just about 12s. These figures ought to be perfectly convincing to everybody in showing that, whatever the grievances may be under which confectioners labour, they cannot blame the Brussels Convention with enhancing the price of their raw material, and that the wild prophecies of dear sugar and consequent industrial disaster, wherewith that international agreement was met at its ratification, have been utterly discredited by actual results. In the interests of Free Trade, and for the encouragement of the growing of sugar in every country suitable for its cultivation, it is sincerely to be hoped that His Majesty's Government will take no steps in the coming year towards the abandonment of the Convention."

The American beet sugar industry is expanding rapidly. In 1900 the crop was not worth seven million dollars, whereas now it is valued at considerably more than forty million dollars. Colorado holds the lead in production, to be followed respectively by California, Michigan, Utah, and Idaho.

Porto Rico is proving a serious rival to Cuba in exports of sugar to the United States. Ordinarily Cuba has supplied nearly two-thirds of all the sugar entering the U.S.A., but in September last this proportion fell to one-third. Porto Rico's shipments have grown from 71,500 short tons in 1901 to 205,500 short tons in 1906 (fiscal year).

DETERMINATION OF SUCROSE AND OF REDUCING SUGARS IN FLUID SACCHARINE PRODUCTS.

By F. G. WIECHMANN, Ph.D.

At the request of Prof. Dr. A. Herzfeld, the writer has made a study of the determination of sucrose and of reducing sugars in fluid saccharine products.

The report herewith respectfully submitted embodies the results of that investigation.

One hundred and five syrups were analysed. All were examined by two methods, while thirty-nine were analysed by three methods.

In all of these determinations Soxhlet's modification of Fehling's solution was exclusively used. The composition of this reagent, separately preserved as Solution I. and Solution II., was:—

Solution I., copper-sulphate 34·639 g. in 500 cc. water.
Solution II., Rochelle salts 173·000 g. in 400 cc. water; sodium-hydrate 50·000 g. in 100 cc. water.

The details of the analytical methods employed follow. For valuable assistance rendered in the practical execution of the work the writer would express his appreciation to his assistants, Messrs. James E. Kelly and Thomas Dorn.

METHOD A.

Take 25 grms. of sample, dissolve up to 250 cc. Of this solution take 50 cc., add to it 20 cc. of $\frac{1}{2}$ normal hydrochloric acid, placing the solution in a 100 cc. sugar-flask. Insert a centigrade thermometer, having the end of its bulb $\frac{1}{4}$ inch from the bottom of the flask, and the said bulb wholly immersed in the solution. From the moment when the thermometer indicates 100° C. boil for exactly $\frac{1}{2}$ minute. Then remove the flask and cool it immediately in ice-water. Empty the contents of the flask into a litre flask, add 10 cc. of a normal sodium hydrate solution, and fill up to the mark with distilled water. Pour some of this 0·5% solution into a burette and effect on it the determination by the volumetric method.

For this determination use:

10 cc. copper sulphate solution.
10 cc. Rochelle salts solution.
20 cc. distilled water.

After a first approximate determination has been made, proceed as follows with the final determination:—Boil the Fehling solution. Run in the saccharine solution 1 cc. short of the amount indicated by the first determination, boil, then add 0·2 cc. each time, boil after

each addition, and test for any remaining copper with a solution of ferrocyanide of potassium and acetic acid as follows :—

Prepare tubes in advance, each containing 1 inch of the solution of ferrocyanide of potassium, prepared by putting 1 drop of a 10% ferrocyanide of potassium solution into 200 cc. of distilled water and 2 drops of acetic acid, of 50% strength.

This gives the total sugars, *i.e.*, the sucrose and the reducing sugars.

For Invert Sugar.—Of the same stock solution (25·0 grammes in 250 cc.) take 10 cc. and make up to 100 cc. with distilled water. With this, a 1% solution, proceed exactly as for the determination of the total sugars, using the same amount of Fehling's solution.

This method is generally known as the English method, and is essentially the method practiced by the English Customs Laboratories. Mr. Alexander Watt was kind enough to furnish the writer with the following description of the method as practiced in England :—

"After some correspondence with Dr. Thorpe, the Chief Chemist in the Government Laboratory, I have only been able to get the following outline of the process used in the Customs Laboratories for testing syrups.

"Dr. Thorpe says :—'The method used in the Government Laboratory for determining the percentage of 'sweetening matter' in syrups and molasses is based upon the reducing effect of the sugars on Fehling's solution, and the volumetric method is employed. The difference between the percentage of reducing sugars (taken as 'invert') before and after inversion is reduced to its equivalent as sucrose—and this is added to the percentage of sugar (as invert) found before inversion to give the total 'sweetening matter.' The causes of the difference between different operators are no doubt due largely to variations in the *amount* and *strength of acid* used and the temperature and *duration of heating* in the process of inversion. If the acid is too strong or the heating too prolonged there is a loss of invert sugar. We have found by experience that by using semi-normal hydrochloric acid and raising to boiling point, then rapidly cooling to ordinary temperature, and neutralizing with soda, the most satisfactory results are obtained. To ascertain the end of the reduction we use an acetic acid solution of potassium ferrocyanide as indicator. The Clerget method may be used, if preferred, for the estimation of the sucrose. All Customs testing stations use the above method.'

"In reply to another inquiry, he says that there is no detailed account of the process published in any of the Parliamentary Blue Books.

"From the Liverpool Customs Laboratory the following extra details were obtained :—

BRITISH CUSTOMS' METHOD OF TESTING SYRUPS.

20 grms. of syrup are dissolved in 1000 cc. water.

Total Glucose.—50 cc. of this solution + 20 cc. semi-normal HCl + 30 cc. water = 100 cc. is gradually raised to the boiling point and kept boiling for one minute, then cooled rapidly, neutralized with caustic soda, and made up to 200 cc. = $\frac{1}{2}$% solution of syrup, which is run into 20 cc. Fehling's solution until no copper is found by testing with acidified potassium ferrocyanide.

Original Glucose.—50 cc. of the above original syrup solution are made up to 100 cc. = 1% solution, which is titrated against 10 cc. Fehling until all the copper is reduced, as before.

(Total Glucose — Original Glucose) × ·95 = Sucrose.

Sucrose + Glucose = Total Sweetening Matter.

Concerning the determination of the end-points of the reaction with ferrocyanide of potassium, Mr. Watt expresses himself, as follows:—

"I think all British chemists filter the partially reduced Fehling solution before testing. I know the British Customs' chemists filter a few drops on to special thick filter paper into contact with a drop of acidified ferrocyanide. Until recently, we have been in the habit of testing in the same way. We now filter nearly $\frac{1}{2}$ cc. into cups in a white porcelain plate (or into a small test tube) containing acidified ferrocyanide and in this way can detect copper with certainty, whereas the method of making spots on filter paper always left us in doubt. But there is another difficulty in ascertaining the end of the reaction, we often find (especially in unclarified solutions) when the reaction is nearly finished, that the copper ferrocyanide colour after having nearly disappeared, increases in intensity on repeated testings.

"My assistants, who constantly observe this, attribute it to the oxidation of the cuprous oxide which goes into solution very readily. The more the boilings are continued to get all the copper reduced, the greater is this difficulty. I do not think that any good results can ever be obtained by the plan of running in the sugar solution gradually, and boiling between each addition, as no two operators give the same number of boilings. I have observed for many years that the error is at least 4% to 5% of the amount of glucose present. Soxhlet's method is, I think, much more likely to give good results. But neither of these takes account of the fact that the reduction coefficient of Fehling varies with the ratio of the glucose to the sucrose present. As the gravimetric method allows for this, if the first part of the operation (*i.e.*, the boiling for three min. according to the instructions) were adopted, and instead of collecting and determining the amount of precipitate the residual were estimated volumetrically, we should obtain accuracy in the reduction, and save time by the substitution of the volumetric for the gravimetric method. Stolle's

process mentioned above does this by means of cyanide of potassium for the estimation of the residue of copper. We are at present engaged in experiments with this process, and find that tests made immediately after each other give very concordant results, but, unfortunately, the cyanide of potassium solution seems to alter very rapidly in value. We have not found out the reason of this yet. I suspect it is impure cyanide, and have ordered another lot. But if this does not succeed there are other methods of estimating the residual copper—by iodine of potassium and sodium hyposulphite, &c."

Method B.

Sucrose.—The sucrose is determined by the German Government method. Weigh out 13·024 grammes of the sample. Dissolve with about 75 cc. of water in a 100 cc. flask. Add 5 cc. hydrochloric acid containing 38 per cent. HCl (sp. gr. 1·188). Heat quickly, in two or three minutes, on a water-bath up to between 67° and 70° C. Then keep at this temperature—as close to 69° C. as possible—for five minutes, agitating the flask constantly. Cool quickly, make up to 100 cc.; then remove 50 cc. by a pipette, place in litre flask, and fill up to 1000 cc. Of this solution take 25 cc. (corresponding to 0·1628 gramme of sample), neutralize all free acid present by adding about 25 cc. of a solution of sodium carbonate prepared by dissolving 1·7 grammes crystallized sodium carbonate in 1000 cc. of water. Then add 50 cc. of Fehling's solution, use about 4 minutes to heat the solution to boiling, and proceed with the obtaining of the cuprous oxide as usual.

To find the amount of total sucrose, use the table published in the German Government Method, Law of July 9th, 1887.

Example:—25 cc. of the inverted solution = 0·1628 gramme of sample, yielded 0·1628 gramme copper. This corresponds to 0·082 gramme sucrose; hence there is present in the sample 50·4 per cent. sucrose.

To determine the invert sugar, use the Herzfeld-Meissl method, description of which follows. The amount of this invert sugar multiplied by 0·95 must be subtracted from the "total sucrose" found, in order to obtain the actual amount of sucrose present. This factor 0·95 is used, because sucrose on inversion yields invert-sugar in the proportion of 95 : 100.

Method C.

The Herzfeld-Meissl method.—Take 1 gramme of syrup; add about 80 cc. of water. Clarify with basic lead acetate and sodium sulphate solution, make up to 100 cc. and filter. Of filtrate take 50 cc. = 0·5 gramme.

Take 25 cc. copper sulphate solution and 25 cc. Rochelle salts solution and bring mixture to boiling. Then add the 50 cc. of syrup solution, again heat to boiling and then boil for exactly two minutes.

Then add 100 cc. cold distilled water and filter through a gravimetric tube. Wash with hot water, alcohol, and ether, and dry to constant weight—about one hour.

Weigh the cuprous oxide and proceed as shown in the following example.

Example.

Weight of syrup taken .. .. 0·5 gram.
Polarization of syrup .. .. 33·6
Cuprous oxide = 0·351

$\cdot 351 \times \cdot 888 = \cdot 3117$ cu.

(1.) $\frac{\cdot 3117}{2} = \cdot 156$

(2.) $\frac{\cdot 156 \times 100}{\cdot 5^*} = 31 \cdot 2$

(3.) Polarization of syrup $= 33 \cdot 6$
$33 \cdot 6 \times 31 \cdot 2 = 64 \cdot 8$

(4.) $\frac{33 \cdot 6 \times 100}{64 \cdot 8} = 51 \cdot 8$

$51 \cdot 8 = \mathrm{R}.$

From the proper table find the nearest value between R. and I. In this case it is 50 : 50, and as the weight of copper found was = ·312, this is multiplied by factor 54·0 obtained from the table.

$\cdot 312 \times 54 \cdot 0 = 16 \cdot 848$

and this value divided by the weight of the syrup taken

(0·5 gram.) = 16·848 ÷ 0·5 = 33·70

and this is the invert sugar present.

The following table records the analytical results obtained by these methods, A, B, and C :—

	A.		B.		C.	
Exp. No.	Sucrose.	Invert Sugar.	Sucrose.	Invert Sugar.	Polarization.	Invert Sugar
1	32·98	35·46	34·23	33·80	33·50	33·80
2	31·83	35·46	34·94	33·37	31·90	33·37
3	30·53	34·97	35·66	32·94	33·40	32·94
4	31·13	33·90	35·16	31·54	33·40	31·54
5	32·55	31·75	37·15	29·43	35·30	29·43
6	32·98	31·95	36·64	30·29	34·60	30·29
7	31·65	32·26	38·29	29·53	35·90	29·53
8	32·97	33·56	36·17	31·43	34·60	31·43
9	34·46	33·90	36·28	31·97	34·90	31·97
10	32·40	37·31	35·76	34·78	33·10	34·78
11	34·85	37·74	33·30	35·75	32·80	35·75
12	29·86	40·00	32·40	38·32	30·70	38·32
13	31·32	38·46	33·55	36·45	30·90	36·45
14	32·49	35·97	35·76	34·13	32·60	34·13
15	31·67	33·33	36·18	31·10	34·40	31·10
16	33·35	33·89	37·10	31·10	33·60	31·10

* ·5 is the weight of syrup taken.

Exp. No.	A. Sucrose.	A. Invert Sugar.	B. Sucrose.	B. Invert Sugar.	C. Polarization.	C. Invert Sugar
17	31·97	33·00	36·33	31·59	34·50	31·59
18	33·86	33·33	37·87	30·94	34·30	30·94
19	31·67	33·33	36·03	31·26	35·40	31·26
20	31·00	34·48	35·57	32·72	34·50	32·72
21	32·45	36·76	35·55	34·67	33·0	34·67
22	30·60	36·76	34·70	34·67	32·9	34·67
23	30·52	37·31	33·45	34·78	33·5	34·78
24	32·41	37·31	34·63	35·32	33·3	35·32
25	32·00	37·74	33·55	36·45	33·0	36·45
26	32·00	37·74	34·63	35·32	33·2	35·32
27	31·93	37·31	35·14	34·78	33·1	34·78
28	32·58	36·63	35·04	34·34	32·7	34·24
29	28·45	34·50	34·95	31·10	32·7	31·10
30	30·52	29·41	36·92	27·13	35·8	27·13
31	31·77	34·48	35·86	31·43	34·7	31·43
32	31·14	32·79	36·34	30·94	35·6	30·94
33	29·50	31·45	35·82	30·18	35·0	30·18
34	34·87	32·26	37·20	30·02	36·0	30·02
35	36·71	32·79	37·41	30·13	35·0	30·13
36	30·14	32·79	36·75	30·18	35·3	30·18
37	30·14	32·79	37·05	30·51	35·4	30·51
38	30·50	33·90	36·28	31·32	34·5	31·32
39	31·07	35·09	35·56	32·40	34·4	32·29
40	32·78	34·50	—	—	33·4	33·48
41	38·38	33·67	—	—	35·0	31·80
42	37·91	34·72	—	—	35·0	31·80
43	36·40	33·11	—	—	35·2	30·40
44	35·87	33·67	—	—	35·2	31·15
45	36·43	33·33	—	—	34·8	30·72
46	34·87	32·26	—	—	33·9	30·18
47	34·87	32·26	—	—	34·0	30·29
48	35·12	32·47	—	—	33·8	30·62
49	37·21	32·26	—	—	34·0	30·29
50	34·68	32·46	—	—	33·4	29·97
51	34·87	32·26	—	—	33·5	29·65
52	37·21	32·26	—	—	34·1	30·40
53	38·16	33·90	—	—	34·5	32·08
54	36·73	34·97	—	—	34·3	33·05
55	36·00	34·84	—	—	34·7	33·26
56	35·71	36·44	—	—	33·6	33·80
57	34·53	35·08	—	—	34·5	33·16
58	35·10	34·48	—	—	35·3	32·99
59	36·67	34·13	—	—	34·8	32·29
60	35·65	33·90	—	—	34·9	31·64

Exp. No.	A. Sucrose.	A. Invert Sugar.	B. Sucrose.	B. Invert Sugar.	C. Polarization.	C. Invert Sugar
61	36·79	31·45	—	—	35·2	30·02
62	37·21	32·26	—	—	36·3	29·59
63	36·02	32·26	—	—	36·1	30·13
64	36·49	32·26	—	—	36·2	30·45
65	35·56	32·26	—	—	34·2	30·88
66	34·38	32·78	—	—	34·3	30·18
67	34·30	33·33	—	—	33·4	31·15
68	35·01	33·33	—	—	33·6	31·43
69	33·56	32·47	—	—	33·4	30·29
70	34·40	32·78	—	—	33·5	30·78
71	35·65	33·90	—	—	35·1	32·07
72	34·40	32·79	—	—	34·0	29·91
73	35·00	33·33	—	—	35·2	30·62
74	35·26	32·57	—	—	35·0	30·18
75	32·56	32·57	—	—	34·4	31·15
76	33·69	33·56	—	—	33·5	32·51
77	35·10	34·48	—	—	33·3	32·08
78	32·75	33·33	—	—	34·3	31·05
79	35·51	32·79	—	—	35·0	30·29
80	34·76	34·84	—	—	35·0	32·83
81	35·36	32·47	—	—	35·0	30·94
82	34·54	33·33	—	—	35·2	31·64
83	35·15	33·67	—	—	35·5	31·15
84	34·13	34·25	—	—	35·3	32·40
85	34·00	33·90	—	—	35·3	32·18
86	33·69	34·72	—	—	35·2	32·62
87	33·69	34·72	—	—	35·1	32·08
88	31·64	32·26	—	—	36·0	30·56
89	28·78	31·25	—	—	37·0	28·30
90	28·34	28·99	—	—	38·0	26·92
91	30·70	30·77	—	—	37·1	28·10
92	34·70	30·38	—	—	36·2	28·41
93	35·17	30·77	—	—	36·1	28·41
94	34·81	30·03	—	—	35·9	28·30
95	32·25	30·57	—	—	35·8	28·94
96	32·96	29·85	—	—	36·1	28·30
97	33·75	29·41	—	—	36·0	28·30
98	33·92	30·96	—	—	35·9	28·62
99	30·32	29·24	—	—	35·9	28·30
100	33·76	32·26	—	—	35·1	31·15
101	31·83	35·46	—	—	33·7	33·80
102	30·92	35·71	—	—	32·7	34·24
103	32·98	35·46	—	—	33·5	33·80
104	31·83	35·46	—	—	31·9	33·37
105	30·00	35·09	—	—	32·5	31·86

Investigation of these data shows that the reducing sugar (invert sugar) as determined by method "A" is in every instance higher than the corresponding values found by methods "B" and "C."

In this connection it is interesting to recall that in method "A" no clarification with basic lead acetate is employed, while such clarification is practised in both methods "B" and "C."

The sucrose value determined by method "A" is in every instance lower than the sucrose value determined by method "B." This is in a measure determined by the methods of calculation employed, as will appear from the following example.

Method A.

Total sugars after inversion .. .. .. = 68·97
Invert .. .. = 32·26

68·97 — 32·26 = 36·71
36·71 × ·95 = 34·8 sucrose.

Sucrose .. = 34·87
Invert .... = 32·26

67·13

Method B.

Total sucrose after inversion . .. .. = 65·72
Invert .. .. = 30·02

30·02 × ·95 = 28·52
65·72 — 28·52 = 37·20% sucrose.

Sucrose .. = 37·20%
Invert .... = 30·02%

67·22

and yet the sum total of the sucrose and of the reducing sugars (invert sugar) is practically identical in the two.

Comparison between the sucrose values of "A" and the polarization values of "C" shows that, in the 105 analyses made, the sucrose value of "A" in 68 instances is lower than the polarization value of "C," and in 37 instances is higher in the former than in the latter.

These variations are in part accounted for by the fact that in one of the methods used—method "C"—one of the values is determined by the polariscope, a most unsatisfactory proceeding when one considers the composition of the materials analysed.

Composition of Fehling's Solution.—As to the question of any possible change in the composition of Fehling's solution, from correspondence which has passed between Messrs. Herzfeld, Watts and the writer, it would appear imperative that the following questions receive careful study before it would be prudent to advise or recommend any change whatever in the present composition of the solution.

In re Gravimetric Analysis Method.

1. Shall the determination of copper reducing substances take place *without*, or *after*, a clarification by basic lead acetate?

3. If *after* a clarification with basic lead acetate, shall any excess of this reagent which may be present in the solution be removed, or shall it not be removed, before the copper-reducing substances are determined?

5. If such excess is to be removed, which reagent shall be used for the purpose? Na_2CO_3; $NaHCO_3$; $NaCl$; Na_2SO_4; Na_2HPO_4; $Na_2C_2O_4$; $K_2C_2O_4$; $(NH_4)_2C_2O_4$; H_2SO_3?

7. Selection of formula for copper solution to be used—composition, concentration for use; preservation.

9. Selection of formula for alkaline solutions to be used with the above selected copper solution—composition; concentration; preservation.

11. Style and size of heating vessels?

13. Source of heating?

15. Time of heating?

17. Area of heating surface?

19. Shall the Cu_2O be reduced to Cu?

21. Shall the Cu_2O be weighed as Cu_2O?

23. Shall the Cu_2O be otherwise changed chemically, and then be determined by titration? if so, by which method?

In re Volumetric Analysis Method.

2. Same as 1.
4. Same as 3.
6. Same as 5.
8. Same as 7.
10. Same as 9.
12. Same as 11.
14. Same as 13.
16. Same as 15.
18. Same as 17.
20. Method and indicator to be used for determining end point of reaction.

In conclusion, and in compliance with the request of our esteemed chairman, Professor Dr. Herzfeld, that suggestions be made for the determination of the sugars in fluid saccharine products, the writer respectfully submits the following recommendations:

1. Retention of the present composition of Fehling's solution, *i.e.*, Soxhlet's modification of Fehling's solution, as previously specified.
2. Clarification with basic lead acetate before the determination of the sucrose and of the reducing sugars.
3. Exclusive use of a gravimetric method for the determination of both sucrose and reducing sugars.
4. Examination of and possible future endorsement by the International Commission of the following gravimetric method of analysis for such determinations.

Method of Analysis.

Weigh out 26·000 grammes of the sample. Dissolve with about 75 cc. of water in a 100 metric cc. flask. Add basic lead acetate solution (International Commission standard) sufficient to clarify, and carefully remove excess of basic lead acetate with a 10% solution of sodium chloride or of sodium sulphate, and then fill up with water to the mark, filter, and of the filtrate take 50 cc. = 13·000 grammes.

Add 5 cc. hydrochloric acid containing 38% HCl (sp. gr. 1·188). Heat inside of three minutes on a water bath up to a temperature of between 67° C. and 70° C. Then hold temperature as close to 69° C. as possible for five minutes, with constant agitation. Cool quickly, make up to 100 cc.; remove 50 cc. by a pipette, place in a litre flask and fill up with water to 1000 cc.

Of this solution take 25 cc. (corresponding to 0·1625 gramme of the sample), neutralize the free acid present by the addition of about 25 cc. of a solution of sodium carbonate prepared by dissolving 1·7 grammes crystallized sodium carbonate in 1000 cc. of water.

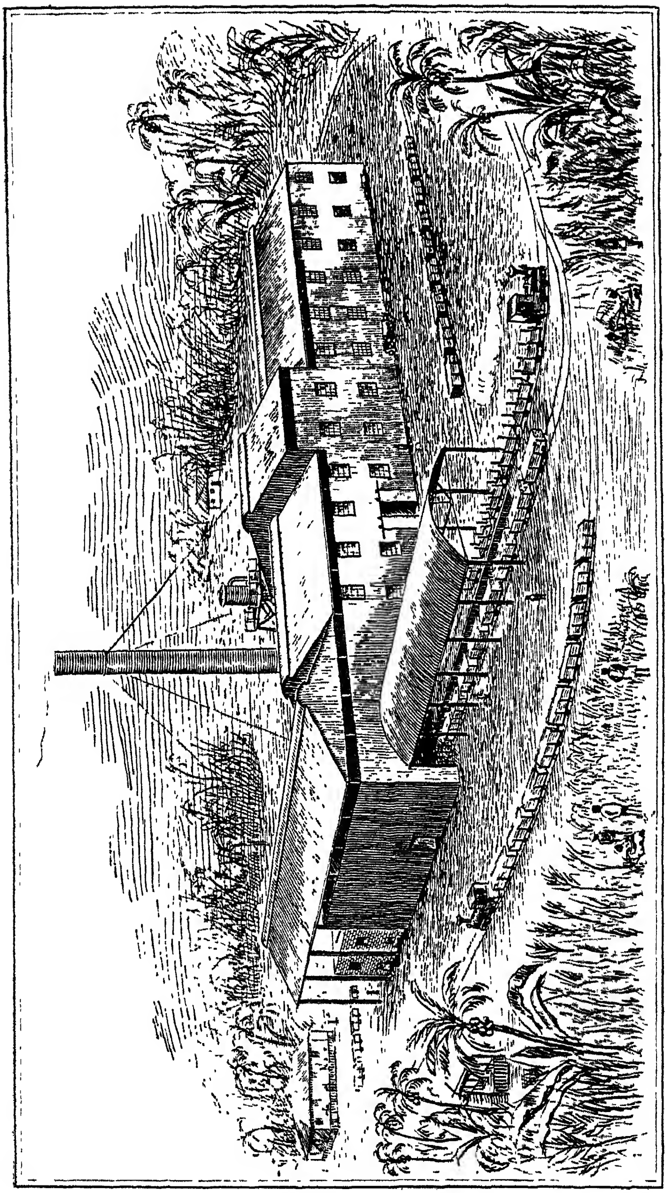
Add 50 cc. of Fehling's solution; heat to boiling in about four minutes, then, from the time that the solution starts to boil, *i.e.*, the time when steam bubbles arise in the centre and also from the sides of the vessel, continue to boil for exactly three minutes with a small flame. Remove flask from flame immediately, add 100 cc. of boiled, cooled, distilled water, filter through an asbestos filter as customary. wash successively with hot water, alcohol, and ether, and then dry for thirty minutes in an air bath in which a temperature of 100° C. is maintained; then cool over calcium chloride and weigh the cuprous oxide as such. Multiply this value by the factor ·888 and obtain the weight of the sucrose from the weight of the copper found, using the table of the German Government (Law of July 9th, 1887). This represents "total sucrose."

Reducing Sugars.—To determine the reducing sugars (invert sugar) take 4 cc. of the solution originally prepared and clarified with basic acetate of lead. Make this up to 100 cc., and from this solution take 50 cc. = 0·520 G. Add 50 cc. Fehling's solution, boil for three minutes, and proceed exactly as previously directed, and then obtain the weight of copper corresponding to the cuprous oxide precipitated, This amount subtracted from the "total sucrose" then gives the actual amount of sucrose present. The sucrose value which has been subtracted from the "total sucrose," and which really represents reducing sugars (invert sugar), is changed to represent the latter by dividing by 0·95, because 100 parts of invert sugar correspond to 95 parts of sucrose.

* * * * *

Since this investigation has been completed, an article by Messrs. Munson and Walker, entitled: "Unification of reducing Sugar Methods," has appeared in the Journal of the American Chemical Society, June, 1906. This is cordially commended to the reader's attention.

The North Side Sugar Planters' Association, of Jamaica, recently adopted a lengthy resolution praying for the renewal of the Brussels Convention, as any recrudescence of bounties would cause a set-back to the sugar industry of the island.



THE VERE CENTRAL FACTORY, JAMAICA.

THE VERE CENTRAL FACTORY, JAMAICA.

On the opposite page will be found an illustration of the new central factory in course of erection for the Vere Estates Company, Limited, Jamaica, which will deal with the crops of at least five sugar estates. With the exception of the railways and rolling stock, the whole of the contract has been let through Messrs. E. A. de Pass & Co., of London, to the Harvey Engineering Co., Ld., of Glasgow.

The buildings, which are entirely of iron, have been made by Messrs. A. and J. Main & Co., Ld., of Glasgow.

The machinery will be of the most up-to-date description, as is to be expected from a firm of the standing of the Harvey Engineering Co., Ld.

The modus operandi is proposed to be as follows:—

The canes after being cut will be collected in the fields by means of trucks run on portable rails, which when full will be drawn by locomotives alongside the cane carriers at the mill. The canes will be tipped on to these by a special apparatus, and will then be carried along to the Krajewski crushers, and thence to the six-roller mill. It may be observed that both crushers and six-roller mill will be driven by the same engine through suitable gearing. The megass is run off on carriers to the Babcock and Wilcox water-tube boilers, which are naturally fitted with suitable furnaces for burning the green megass. The juice passes through a mechanical strainer and is then treated according to the kind of sugar desired. After the subsiders and eliminators comes the triple effet, one of Harvey's well-known design. From these the juice goes to the syrup eliminators and then to the vacuum pan supply tanks. Two vacuum pans are provided, and both pans and triple effets are connected up with one central barometrical condenser, fitted with one of the most improved types of dry air pumps.

The masse-cuite is discharged into a range of crystallizers, and from these goes on to the water-driven centrifugals, whence after curing the finished product is mechanically conveyed to the sugar stores.

Besides the above buildings, there is a distillery house and range of workshops, not shown in the illustration.

The Vere Estate is noted for the fertility of its soils, and as steam ploughing is about to be introduced, the result of the Company's operations is likely to be of no small moment in the industrial life of Jamaica; but it is to be hoped that the disastrous earthquake which has just destroyed Kingston will not have done any material harm to this new venture.

SUGAR WASHING AND PATTERSON'S SYRUP CLASSIFYING APPARATUS.

The classification of syrups has long been practised in Germany, where every detail in the process of sugar manufacture is carefully studied. In no case is juice or syrup of a higher purity allowed to mix with that of a lower; and low syrups are only added to masse-cuites of higher purity to form mother syrup for the crystals already formed. Mixing in the sugar industry, whether it be the factory or refinery, should be carefully avoided or controlled, and every effort to maintain the purity of juice and syrup encouraged.

Perhaps more mixing takes place at the centrifugals than at any other station in the factory or refinery. Here the finished sugar is purged from molasses, and, no matter how pure, it always retains a coating of the mother syrup in which it was boiled, and the coating is greater and more highly coloured in proportion to its viscosity and impurity. When this sugar has to be brought to a standard colour or polarization, as is now customary in Java, Cuba, and the West Indies generally, as well as in the refining industry, some further treatment is required to remove the coating of mother syrup. The simplest and universally adopted method is to treat the sugar in the centrifugal with more or less water. This washing process is satisfactory so far as removing the coat of mother syrup is concerned, but it goes further than that and dissolves large quantities of the sugar crystals, which reduces the yield. According to its temperature, every pound of water so used dissolves two or three pounds of sugar. The water saturated with sugar, mixes with the molasses or syrup in the casing, runs off with the molasses, and the sugar it contains is lost to the grade of sugar treated. The washings are very pure, often purer than the liquor or syrup from which the masse-cuite was boiled, therefore every effort should be made to separate them. Speaking generally, the more water required the purer are the washings. Consequently, manufacturers and refiners, aware of these facts, limit the quantity of water as much as possible, and often make a rough separation of the washings by turning the discharge of the centrifugal, made movable for the purpose, into another channel. With a good separating centrifugal no necessity exists for stinting the water, since all the sugar washed out will be recovered in the next pan of the same grade.

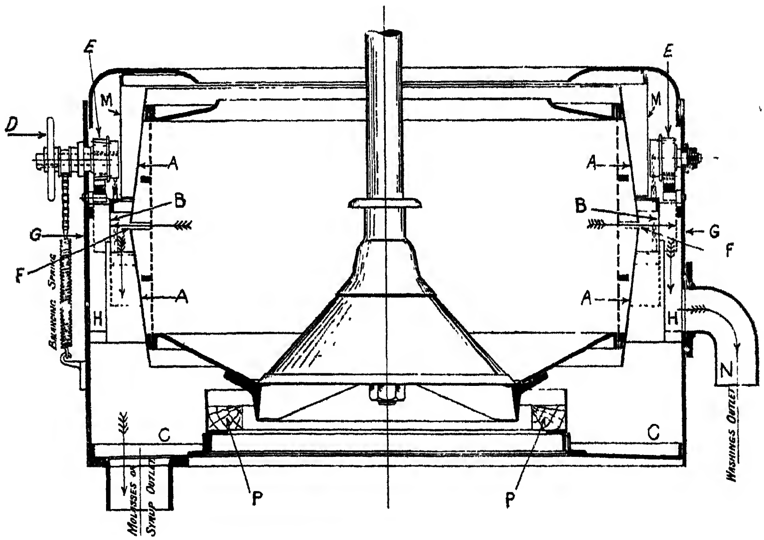
Claassen, in his recent book on Beet Sugar Manufacture, writing on the subject of washing with liquor and water says, p. 184 :—"The chief requirement for a good yield is the careful separation of the syrup thrown off by centrifugation, according to its purity, so that the better portions can be again boiled down with the thick juice for the production of sugar crystals." After the green syrup is removed

the syrup "next obtained in the washing process is at first carried off into the green syrup gutter, but as soon as it becomes lighter coloured it is run into a different gutter and either carried back directly to the thick syrup" which is again used for washing, "or it is added by itself to the vacuum pans during the boiling process." But it is impossible to make a good separation of the washings by means of a swivel spout, because the green molasses is so viscous that it cannot completely run off the inside of the casing and out of the machine before washing commences, and this is also the case when some time has been allowed for the purpose. The inside of the casing presents a very great surface to which the heavy molasses adheres with considerable tenacity; and the gutter beneath is generally more or less dammed with splashes of thick masse-cuite or lumps of hard sugar, forming the molasses into pools, which polute the washings, lower their purity and render such efforts to save them abortive. Prinsen Geerligs, in his useful book on Cane Sugar and its Manufacture in Java,* whilst expressing the desirability of being able to thoroughly separate the washings from the sugar, points out the defects of the swivel arrangement when he says, p. 60, "This is, however, not quite sufficient as the viscid poor molasses have not yet entirely left the outer drum when covering has already started so that a partial mixing of the two in the outer drum cannot be avoided." Geerligs mentions two methods for giving purer washings. In one, the machine is made to revolve in both directions; necessitating special driving arrangements and the stopping and starting of the machine twice for each charge. In the other, two sets of machines are required and the rough sugar scooped out of one set, is put through a pug mill with thin syrup and washed in the other, involving much labour and a double curing plant.

"In other methods of separation" Claassen says, "the syrups of different degrees of purity are separated in the casing of the centrifugal apparatus itself, so that here the separation is a sharp one, to the extent that it is possible to remove the syrup by centrifugation." Patterson's Patent Syrup Classifying Apparatus is one of these. It solves the mechanical difficulty in a simple and practical manner; and in the words of a refiner who has installed a number of these machines, "it is admirably adapted for the purpose for which it was designed." No extra labour is required, for in the ordinary process of purging it catches the washings, at their birth so to speak, and discharges them by a separate gutter or spout. As will be seen from the accompanying engraving, the apparatus is fitted in the centrifugal machine between the basket and the casing, and requires three or four inches more room all round than is ordinarily found there. It consists of two cones attached to the basket, top and bottom, so that their bases nearly meet in the centre. These cones AA deliver the molasses from

* Second edition.

the annular opening F, and not all over the casing like an ordinary centrifugal basket. Besides the usual gutter in the bottom, another narrow and deep gutter H is placed inside the casing for the washings; its top being below the level of the annular opening formed by the cones. A movable guard B suspended by four chains from an equal number of pulleys E controlled by a hand wheel D on the outside, hangs between the basket and washings gutter. The weight of the movable guard is balanced by a spring attached to the hand wheel. Thick copper wire cloth G suspended over the washings gutter prevents splash; the fixed guard M protects the gearing from "spill" and the blocks P secure the apparatus in case of excessive oscillation.



The centrifugal is charged and spun with the movable guard raised as shown in the engraving. The molasses, caught on the cones attached to the basket, are at once discharged by centrifugal force and conducted by the movable guard to the usual gutter in the bottom, leaving the cone surfaces clean and ready for immediate washing. When washing commences, the guard is lowered by the hand wheel out of range of the annulus, the washings are caught on the copper wire cloth and conducted out of the centrifugal by the special gutter. The washings gutter is always clean and free from molasses contamination, and there is no danger of mixing. One great advantage of the apparatus is this, that it permits the free use of water without fear of losing sugar to the molasses, since the washings are recovered in the form of masse-cuite in the next pan of equal purity.

Patterson's syrup classifying apparatus can be fitted to any make or size of centrifugal and will be found indispensable in the treatment of the first and last products of the factory, the first products of the refinery, and, of course, in all cases where sugars are washed in the centrifugal. The use of this apparatus makes it possible to turn out of the centrifugal washed sugar from the crystallizers and exhausted, undiluted molasses, at one operation. Several installations of centrifugals fitted with this apparatus have been erected in factories. where they are giving great satisfaction.

As an indication of the results to be obtained in the practical working of this apparatus we may say that, were 5% of water required to wash a fine sugar, such as granulated, up to colour, more than 8% of the purged sugar would be dissolved. Whilst with cane first product sugars washed to approximate whiteness, perhaps as much as 10% of water or more will be required, when about 18% of the crude sugar would pass into solution. But in neither case would these amounts be lost in the molasses. The washings are equally rich with the liquor or syrup from which the masse-cuites were made, and returning to the pan to be boiled into the next filling of the same grade, would increase the yield of first sugars by nearly the amounts washed out. Similar results are obtainable when washing crystallizer sugars up to 96% polarization, and in all cases where washing is necessary; only it is not possible to say how much will be dissolved by a given percentage of water. because of the great variation in composition and viscosity of the mother molasses. It is certain, however, that this apparatus makes it possible in the raw sugar industry, to crystallize more sugar out of low purity syrups on to first product sugars in the pan than hitherto, without the danger of making sugar below the standard. And with good crystallization and washing, it should be possible to work the whole sugar crop up to standard polarization, without remelting or producing a lower product than exhausted molasses.

The German statistics of sugar exports, January to November, 1906, show an increase of 80%. India took 49,000 tons of granulated against 1,700 in 1905; and Chili took 13,000 tons of cubes against 2,000 tons the previous year.

The Russian sugar refiners desire their Ministry of Finance to raise the bounty on sugar intended for export from 1 to 2¼ roubles per pood (1 pood = 36 lbs.). This change is considered necessary owing to the difficult situation which has arisen in connection with the export of sugar from Russia.

ANALYSIS OF SUGAR BEETROOT.

England.

Reference No.	The Trials were made by	Farming at	What kind of Soil.	What Manure was used, and How much per Acre.	Yield of Roots per Acre.	Length of time of Vegetation.
					Tons.	Days
1	University College of North Wales	Nanhoron, Carnarvonshire....	Heavy	3 cwt. superphosphate, 4 cwt. kainite, $1\frac{1}{2}$ nitrate of soda	15	150
2	Do. do.	Madryn, Aber, Carnarvonshire	Light, gravely soil	Do. do. do. ..	16	178
3	Arthur Symonds..............	Rockylls Hall, Shelland, Suffolk	Mixed clay, subsoil clay ..	10 loads farmyard manure, 2 cwt. superphosphate	18	183
4	Do.	Do. do. ..	Do. do. ..	10 loads farmyard manure, 7 cwt. mangold manure	17	183
5	Do.	Do. do. ..	Do. do. ..	10 loads farmyard manure, 4 cwt. superphosphate, 1 cwt. nitrate of soda	18	183
6	University College of North Wales	Glan'rafon, Pontrug, Carnarvonshire	Light loam	3 cwt. superphosphate, 4 cwt. kainite, $1\frac{1}{2}$ nitrate of soda	16	161
7	Do. do.	Penarth, Clynnog, Carnarvonshire	Do.	Do. do. do. ..	15	154
8	Edward W. Powell	Winforton Court Farm, Herefordshire	Sandy, over gravel........	5 cwt. bone compound	19	186
9	W. W. Pope	Newton Farm, Newent, Gloucestershire	Sandy	5 cwt superphosphate	18	186
10	G. E. Bellringer	Grove Court Farm, Upton, Gloucestershire	Light marl................	5 cwt. mangold manure	17	174
11	J. H. Nicholls	Pool Hall Farm, Shropshire ..	Stiff clay	5 cwt. Manchester Corporation manure ..	19	177
12	Rev. E. Muckleston, M.A.	Haseley Farm, Warwickshire..	Light, sandy..............	Farmyard manure	19	192
13	George Clark	Church Farm, Podymore, Somerset	Sandy, gravel subsoil	Do. and 4 cwt. superphosphate..	17	158
14	A. W. Young	Barton Farm, Sherborne, Dorset	Stone brash on rock	Farmyard manure	18	157
15	W. Wyatt Paul	Manor Farm, Bradford Abbas, Somerset	Light, sandy..............	15 tons farmyard manure, $1\frac{1}{2}$ cwt. nitrate of soda, 5 cwt. of salt	19	144
16	Samuel Brake	Higher Farm, Lymington, Somerset	Clay, rocky subsoil........	25 loads farmyard manure, 5 cwt. mangold manure	18	143
17	Ernest Jenner	Cugley Farm, Newent, Gloucestershire	Sandstone loam	5 cwt. artificial manure	18	185

Reference No.	Previous Crop.	Compared with Licht, Magdeburg.				Mette.					Aderstedt.									
		Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.	Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.	Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.
1	Oats	544	17·23	2·37	87·91	590	15·40	2·20	87·50	14·60	611	17·60	2·20	88·88	16·00	..	..	..	..	..
2	Do.	544	17·23	2·37	87·91	766	16·80	3·20	84·00	15·30	955	17·60	2·90	85·85	16·40	..	..	..	..	..
3	Barley	544	17·23	2·37	87·91	..	..	..	..	..	766	16·50	2·60	86·38	15·40	..	..	..	..	..
4	Do.	544	17·23	2·37	87·91	..	..	..	..	..	680	18·90	3·30	85·13	16·10	..	..	..	..	..
5	Do.	544	17·23	2·37	87·91	..	..	..	..	..	801	17·90	2·50	87·74	16·20	..	..	..	..	..
6	Oats	544	17·23	2·37	87·91	512	14·70	2·50	85·46	14·00	533	17·50	2·60	87·06	16·40	..	..	..	..	..
7	Grass	544	17·23	2·37	87·91	914	14·30	2·60	84·61	13·80	791	15·60	2·60	85·71	14·60	..	..	..	..	..
8	Oats	544	17·23	2·37	87·91	..	..	..	..	..	943	16·50	3·00	84·61	15·50	..	..	..	..	..
9	Barley	544	17·23	2·37	87·91	..	..	..	..	..	882	16·70	2·20	88·35	15·80	..	..	..	..	..
10	Do.	544	17·23	2·37	87·91	..	..	..	..	..	990	17·30	2·40	87·81	16·00	..	..	..	..	..
11	Wheat	544	17·23	2·37	87·91	..	..	..	..	..	810	18·00	3·70	82·95	16·00	..	..	..	..	..
12	Potatoes	544	17·23	2·37	87·91	..	..	..	..	..	1026	16·80	2·40	87·50	16·00	..	..	..	..	..
13	Wheat	544	17·23	2·37	87·91	.	..	..	..	..	942	18·40	3·20	85·19	16·80	..	..	..	..	..
14	Do.	544	17·23	2·37	87·91	..	..	..	..	..	972	17·40	2·70	86·56	16·10	..	..	..	..	..
15	Rye	544	17·23	2·37	87·91	..	..	..	..	..	1008	17·20	2·20	83·65	16·20	..	..	..	..	..
16	Wheat	544	17·23	2·37	87·91	..	..	..	..	..	817	16·70	2·20	88·35	15·90	..	..	..	..	..
17	Do.	544	17·23	2·37	87·91	..	..	..	..	..	744	14·60	2·50	85·38	14·00	..	..	..	..	..

ENGLAND.—*Continued.*

Reference No.	The Trials were made by	Farming at	What kind of Soil.	What Manure was used, and How much per Acre.	Yield of Roots per Acre.	Length of time of Vegetation.
					Tons.	Days
18	John Woolston, J.P.	North Fields Farm, Stamford, Lincolnshire	Medium clay	15 loads farmyard manure, and nitrate of soda	19	130
19	E. A. Smith, J.P.	Longhills Farm, Lincolnshire.	Loamy, limestone subsoil.	2 cwt. nitrate of soda, 4 cwt. kainite, 4 cwt. superphosphate	19	162
20	Corporation of Northampton	Irrigation Farm, Ecton, Northampton	Black gravel	Liquid sewage	26	184
21	W. H. Watson	Temple Bruer, Lincolnshire	Sandy loam on limestone.	8 loads farmyard manure and mangold manure	19	168
22	W. Sardeson	Kirkby, Laythorpe, Lincolnshire	Sandy	Mangold manure	18	165
23	J. Brocklebank	Carleton Le Moreland, Lincolnshire	Do.	12 loads farmyard manure, 3 cwt. superphosphate	18	127
24	F. W. Sreath	Boughton, Hedington, Lincolnshire	Clay	10 loads farmyard manure, 4 cwt, superphosphate	16	171
25	R. W.Burchnall	Branston Rectory Farm, Lincolnshire	Limestone	10 loads farmyard manure, 1 cwt. nitrate of soda	19	179
26	George Marris	Kirmington, Lincolnshire	Deep subsoil chalk	10 loads farmyard manure, 6 cwt. mangold manure, 1 cwt. of nitrate	17	183
27	L. W. F. Behrens	Trinalls Farm, Marazion, Cornwall	Medium	15 tons farmyard manure	19	168
28	University College of North Wales	Nanhoron, Aber, Carnarvonshire	Heavy	3 cwt. superphosphate, 4 cwt. kainite, 1½ cwt. nitrate of soda	19	150
29	Do. do.	Madryn, Aber, Carnarvonshire	Light, gravelly soil	Do. do. do.	18	178
30	Do. do.	Penarth, Clynnog, do.	Light loam, newly broken up	Do. do. do.	18	154
31	Do. do.	Glan'rafon, Pontrug, do.	Light loam	Do. do. do.	16	161
32	W. B. Burtt	Wellingore, Lincolnshire	Strong loam	Mangold manure, 1 cwt. nitrate of soda	15	161
33	F. G. Mountain	Broadholme, Essendine, Lincolnshire	Do.	12 loads farmyard manure, 4 cwt. mangold manure	19	157
34	W. C. Brown	Appleby, Lincolnshire	Sandy clay	10 loads farmyard manure, 6 cwt. artificial manure	19	159

Reference No.	Previous Crop.	Compared with Licht, Magdeburg. Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Mette. Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.	Aderstedt. Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.	Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.
18	Wheat	544	17·23	2·37	87·91	..	..	..	..	..	975	18·30	2·40	88·40	16·00	..	..	..	..	..
19	Do.	544	17·23	2·37	87·91	..	..	..	..	..	970	16·70	2·70	86·08	15·80	..	..	..	..	..
20	Mangolds	514	17·23	2·37	87·91	..	..	..	..	..	913	17·10	2·70	86·36	16·00	..	..	..	..	..
		Compared with Licht, Magdeburg.				Vilmorin (White).					Vilmorin (Red Top).					Klein Wanzleben.				
21	Peas	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	974	17·30	2·30	88·20	16·10
22	Potatoes	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	788	17 40	2·20	88·17	15·50
23	Wheat	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	811	16·60	2·60	86·45	15·30
24	Barley	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	790	16·40	2·50	86·77	15·10
25	Wheat	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	881	17·60	2·70	86·69	15·60
26	Do.	544	17·23	2·37	87·91	803	19·70	2·90	87·17	17·20	..	..	..	..	..	..	..	..	..	..
27	Vegetables	544	17·23	2·37	87·91	..	..	..	..	..	894	17·30	2·40	87·81	16·00	..	..	..	..	..
28	Oats	544	17·23	2·37	87·91	720	17·70	2·40	88·06	15·90	810	14·70	2·20	86·98	15·90	680	16·80	2·60	86·54	15·80
29	Do.	544	17·23	2·37	87·91	1106	17·30	2·40	87·81	16 00	986	18·30	2·60	87 56	17·10	841	18·00	2·20	89·10	16·20
30	Grass	544	17·23	2·37	87·91	811	17·10	2·30	88·14	16·00	880	16·50	2·20	88·23	15·60	773	16·70	2·40	87·43	15·40
31	Oats	544	17·23	2·37	87·91	544	16·30	2·40	87·11	15·10	496	16·10	2 90	84·65	14·10	610	16·80	2·60	86·59	15 20
32	Barley	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	896	17·20	2·90	85·57	15·90
33	Wheat	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	1124	16·80	2·40	87·50	15·90
34	Cabbage	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	785	17·90	2·40	88·17	16·20

England.—*Continued.*

Reference No.	The Trials were made by	Farming at	What kind of Soil.	What Manure was used, and How much per Acre.	Yield of Roots per Acre.	Length of time of Vegetation.
					Tons.	Days
35	Corporation of Burton-on-Trent	Sewage Farm, Burton-on-Trent, Derbyshire	Gravelly loam	None	18	182
36	Do. do.	Do. do.	Do.	Do.	18	182
37	John Chivers, J.P.	Impington Farm, Cambridge	Mixed clay	10 tons farmyard manure, 5 cwt. superphosphate, $1\frac{1}{2}$ cwt. sulphate of potash, $1\frac{3}{4}$ cwt. sulphate of ammonia	19	192
	Average result of the 37 Experiments in England in the year 1906				18	167
	Compared with German grown Roots according to Licht				..	..

Ireland.

Reference No.	The Trials were made by	Farming at	What kind of Soil.	What Manure was used, and How much per Acre.	Yield of Roots per Acre.	Length of time of Vegetation.
38	T. Jennings, J.P.	Brookfield, Cork	Drift on limestone	None	20	152
39	Ashbourne Agricultural Co.	Woodlawn, Dunraven, Co. Dublin	Light loam on granite	6 cwt. sol. phosphate	19	154
40	County Council, Waterford, per John Johnston	Smoorbeg, Co. Waterford	Loam on silurian formation	4 cwt. superphosphate, 2 cwt. salt, 1 cwt. nitrate of soda, 2 cwt. kainite, 15 tons farmyard manure	18	169
41	Do. do.	Do. do.	Do. do.	Do. do. do.	18	169
	Average result of the 4 Experiments in Ireland in the year 1906				18	161
	Compared with German grown Roots according to Licht				..	..

Scotland.

Reference No.	The Trials were made by	Farming at	What kind of Soil.	What Manure was used, and How much per Acre.	Yield of Roots per Acre.	Length of time of Vegetation.
42	Agricultural College, Glasgow	Experiment Farm, Kilmarnock Ayrshire	Light soil, gravel subsoil	20 tons farmyard manure, 6 cwt. superphosphate, 6 cwt. kainite, 1 cwt. nitrate of soda	11	184

Reference No.	Previous Crop.	Compared with Licht, Magdeburg.				Vilmorin (White).					Vilmorin (Red Top).					Klein Wanzleben.				
		Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.	Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.	Average weight in grammes.	Sugar in 100 parts of Juice.	Non-sugar in 100 parts of Juice.	Purity.	Sugar in 100 parts of Roots.
35	Beet	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	888	17·70	2·60	87·19	16·00
36	Do.	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	914	17·60	2·70	86·69	16·40
37	Wheat	544	17·23	2·37	87·91	..	..	..	..	..	..	..	..	..	..	856	17·90	2·40	88·17	16·30
Average result of the 37 Experiments in England....		..	..	..	..	827	17·45	2·56	86·85	15·71	..	..	..	..	..	..	..	..	..	..
Compared with German grown Roots		..	..	..	..	544	17·23	2·37	87·91	14·85	..	..	..	..	..	..	..	..	..	..
		Compared with Licht, Magdeburg.				Klein Wanzleben.					Aderstedt.									
38	Grass	544	17 23	2·37	87·91	..	..	..	..	..	914	17·90	2·30	88·61	16·10	..	..	..	..	..
39	Peas	544	17·23	2·37	87·91	925	17·20	2·20	88·65	16·00	..	..	..	..	..	..	..	..	..	..
40	Oats	544	17·23	2·37	87·91	877	17·30	2·30	88·26	16·00	..	..	..	..	..	..	..	..	..	..
41	Do.	544	17·23	2·37	87·91	795	16·90	2·70	86·22	15·70	..	..	..	..	..	..	..	..	..	..
Average results of the 4 Experiments in Ireland		..	..	..	..	877	17·32	2·37	87·93	15·95	..	..	..	..	..	..	..	..	..	..
Compared with Germau grown Roots		..	..	..	..	544	17 23	2·37	87·91	14·85	..	..	..	..	..	..	..	..	..	..
42	Oats	544	17·23	2·37	87·91	801	16·80	2·60	86·55	15·70	..	..	..	..	..	..	..	..	..	..

QUARANTINE WORK IN THE HAWAIIAN ISLANDS.

The Report of the Board of Commissioners of Agriculture and Forestry in the Hawaiian Islands contains some notes on the agricultural and horticultural quarantine work in connexion with sugar cane pests. Some examples of the work are cited.

Thus a box of sugar cane arrived from Australia was found to be infested with boring lepidopterous larvae measuring from $\frac{1}{16}$ to $\frac{3}{4}$ of an inch. Those worms burrow into and under the buds, destroying them for cuttings, and injuring the vitality of the cane. A number of "mealy bugs" (*Pseudococcus*) was also found under the leaves, as it was a new variety of cane, and being desirous of thoroughly disinfecting it from "bud worms," a strong charge of carbon-bisulphide was used. Evidently, however, sugar cane will not stand as strong a charge of that vapour as grape vines, or other plants or seeds requiring treatment by that method, for most of the cane was killed as well as the budworms and "mealy bugs."

Another importation of sugar cane received from Fiji was treated with hydrocyanic acid gas before unpacking in order to destroy any insects that might have developed in coming through the tropics and be liable to escape when the case was unpacked. Each piece was inspected with the following result: One cane borer beetle and two larvae of the same; one larvae of a small *Buprestid* beetle cutting a transverse tunnel slightly under the surface, also a few adults and larvae of "mealy bugs" (*Dactylopius calceolariae*).

Two packages of sugar cane cuttings came in by mail from Queensland; upon inspection the cane was found to be seriously attacked by a skin fungus, first appearing on the cane in small pustul-like protuberances, afterwards rupturing the skin from which issue the black fungus threads; besides the above fungus, strong colonies of "mealy bugs" were hidden at the base of the leaves that were in a healthy condition and breeding as if they were in a cane field. The cane and packing was burned, saving samples of each pest in glass jars containing formalin.

Another importation of sugar cane, this time from the Philippine Islands, consisted of two packages done up in bamboo. The sugar cane contained evidence of what appeared to be a *Lepidopterous* cane borer and numerous punctures made by "leaf-hoppers." Both cane and packages were consigned to the fire.

RECENT IMPROVEMENTS IN BEET-DIFFUSION AND THEIR PRACTICAL AND ECONOMIC INFLUENCE ON THE CRISIS IN THE SUGAR INDUSTRY.*

By M. A. Aulard.

(Read before the Congress at Amiens.)

The crisis in the sugar industry, far from disappearing, becomes more and more acute in view of the fact that beet sugar cannot be produced as economically as colonial sugars, with which it has to compete in the world's markets. In order to reduce the cost of manufacture and the losses of sugar we have been compelled to extract the whole of the sugar from the beetroot; that remarkable plant which improves year by year.

Whereas producers of colonial sugars are in possession of a fuel (megass), the cost of which is included in the price paid for the canes and fluctuates only with the price of sugar, producers of beet sugar have seen the price of coal almost double itself within a period of five years, with the result that notwithstanding the reduced consumption of coal this important item in the cost of manufacture has been maintained fairly constant for some years.

Contrary to an opinion once expressed by us, we agree with our eminent colleague, M. Vivien, and others in the necessity of sparing no effort to secure a richer variety of beetroot and, at the same time, heavier yields per hectare. Success in this direction appears likely in view of certain results already obtained and other general signs. If within two or three years we succeed in producing an average crop of 38,000 kilos of beetroots per hectare, containing 16·5% of sugar, or 6,270 kilos of sugar per hectare, we should be able to hold our own against the majority of cane sugar producers. Such yields have already been obtained and have even been exceeded by certain cultivators who have provided themselves with carefully selected seed.

Nor are means lacking whereby the losses during manufacture may be diminished and the whole of the sugar extracted in a marketable form, but instead of taking the bull by the horns we hesitate before making the necessary alterations in our factories in order to improve same at any cost.

The most essential operation in the factory, namely, the extraction of the sugar by diffusion, remained neglected for a long time, but to-day scientific men such as Claassen, Naudet, Pellet, Steffen, Saillard, Vivien, and many others are occupied with new or improved methods whereby losses of sugar are minimised and the extraction rendered more efficient.

* Translated from the *Bulletin des Chimistes.*

I am not exaggerating when I state that diffusion losses amount to from 0·50 to 0·55, or 3·43% of the sugar entering the factory, as is proved by a series of observations carried out by our colleague Saillard on behalf of the Syndicate of Sugar Fabricants of France. In usine A he found a loss of 0·45 during diffusion, with a total loss of 0·98; and in usine B a loss of 0·56 during diffusion with a total loss of 0·82.

At the Sucrerie d'Amougies, where nearly fifty million kilos of roots were worked up during the last campaign, the average loss during diffusion was 0·52, and the total loss about 1·0%. I am aware that many fabricants claim to lose only from 0·25 to 0·30—a claim which is easy to make and highly complimentary to those who make it, but they actually lose more than this since we are here concerned not with the *apparent* but the *actual* losses, that is to say, those which result from the juices obtained being more or less impure.

Before entering into details concerning two processes which have attracted much attention although absolutely dissimilar and even opposed to each other—namely, the processes of Naudet and Carl Steffen—I will rapidly review some improvements recently introduced by Claassen, Vivien, Hyros-Rak, and H. Pellet.

From a study of the past we may learn something about the future and what follows is borrowed from a paper in the *Sucrerie Belge* (May, 1906), by M. F. Sachs.

In 1874, when only one diffusion plant existed in France, M. Sostmann utilised the water from the cossette-presses in the diffusion battery; this water being passed through a strainer placed obliquely over a receiving tank whence it was pumped into a second tank situated six metres above the top of the diffusers, and there treated with a small quantity of lime.

Some years later M. Crahé attempted a more perfect purification of these press-waters by adding 1½% of lime, followed by carbonatation, until the alkalinity was reduced to 0·02 to 0·03, the water containing from 0·25 to 0·31% of sugar. This method was adopted in various usines in France up to the year 1886 by the Brothers Delarue, Raisone, Bruai, amongst others, who were able to supply me with very interesting information on the subject.

At a Conference held at St. Quentin, in 1881 or 1882, M. Vivien recommended a perforated flooring below the diffusers and beneath this flooring a suitable tank to receive the drainage water from the diffusers as well as the waters extracted by the presses. This arrangement was advocated as a means of economising the water.

In 1883, Turcke patented a process of purifying the water from the presses with lime so that these might be used again. The utilization of such waste waters led to a great controversy some 20 or 25 years ago, when I was one of those who strongly opposed the practice.

Thus, in an article in the *Revue Universelle des Progrés de la Fabrication de Sucre* for 1886, I wrote as follows:—"Having examined the Schaker Press, I have no hesitation in recommending its adoption by those fabricants who, fearing a deficiency in their supply of water for the various purposes of the factory, are inclined to follow the advice of M. Vivien by using the impure waters which drain from the diffusers."

Riedet, also, advocated this practice in 1880, and proposed an ingenious arrangement for supplying the battery with fresh water or the waste waters by means of a double-acting pump; an arrangement which might be adopted to-day.

These waters have been utilized in Germany only during the last few years as a means of reducing the losses of sugar during diffusion, whereas in Russia the practice had been followed advantageously at the Perepliotchikow Usine, in 1898. Finally, during the past campaign, MM. Pfeiffer and Heicke have overcome all difficulties connected with the practical application of these drainage-waters, and have, consequently, eliminated the losses of sugar which occurred when these waters were run to waste. As the result of some interesting statistics Sachs concludes that the simplest and the most effective plan is to mix the waters drained off from the diffusers and presses with fresh water, and to employ this uniform mixture in the diffusion battery.

This is essentially the process of Professor H. Claassen, and consists in mixing the two impure waters with a minimum quantity of fresh water. Although there is no diminution in the losses during diffusion, the sugar remains in the pulp and thus increases its nutritive value for feeding stock. But in order to gain this advantage the pressed pulp must be passed through a drying apparatus.

Professor Claassen has compared his method of working with that formerly adopted by treating the same roots simultaneously in two batteries, the extraction being carried to the same degree in both cases. Each battery was composed of eight diffusers but only six were operated, 110 litres of juice being drawn off per 100 kilos. of roots, the diffusion being completed in about one and a half hours. The diffusers were maintained at a temperature of from 72°-75°C.; water entering the terminal diffuser at 55°-60°C. As soon as the exhausted cossettes were discharged from the battery the excess water was drained off, passed through a strainer, and collected in a reservoir to which the water from the presses also escaped. Fresh water was then admitted automatically and the mixture returned to the diffusers by means of a pump operated by a float. As the drainage waters were thus returned to the diffusers within a few minutes they were not appreciably cooled and underwent no alteration which might be objectionable.

The following figures indicate the composition of the diffusion juice obtained by the two methods:—

	Claassen's Process.	Ordinary Diffusion.
Brix	14·13	13·87
Polarization	12·38	12·10
Purity	87·50	87·20
Acidity per cm^3	1·00	1·02

Some are of opinion that the waters which escape from the cossette presses are decidedly less pure than the waters draining from the diffusers. In order to prove that this is not so, Dr. Claassen gives the composition of the juice in each diffuser of the same battery; the samples being taken from the air-vents. The following are the results obtained in these experiments:—

		Experiment No. 1.			Experiment No. 2.			Experiment No. 3.		
		Brix.	Poln.	Purity.	Brix.	Poln.	Purity.	Brix.	Poln.	Purity.
Diffusion Juice from No.	1	14·35	12·42	86·55	12·65	11·13	88·0	—	—	—
Juice from Diffuser	2	14·70	12·90	87·7	13·4	11·79	88·0	13·1	11·46	87·4
" " "	3	11·6	9·78	84·3	10·7	9·00	83·5	10·1	8·47	83·9
" " "	4	8·9	7·31	83·1	7·8	6·54	83·8	8·0	6·03	76·4
" " "	5	6·5	4·96	76·3	5·6	4·47	79·8	5 3	4·06	76·0
" " "	6	4·0	3·03	75·8	3·9	1·95	74·9	3·4	2·45	72·2
" " "	7	2·2	1·48	67·3	2·65	1·73	65·3	2·0	1·38	69·0
" " "	8	1·4	0·57	40·7	1·3	0·88	67·7	1·1	9·68	61·8
" " "	9	—	—	—	0·5	0·29	58·0	0·4	0·19	47·5

The analysis of the press-waters obtained in Claassen's process gave:—

	Brix.	Polarization.	Purity.
Experiment No. 1	2·0	1·23	61·5
" " 2	2·5	1·65	65·0
" " 3	1·2	1·35	66·8

It will be noted that for juices of the same density the purities of the diffusion-waters and press-waters are almost the same.

The average analyses for the campaign gave the following percentages of sugar in the:—

	Claassen's Process.	Ordinary Diffusion.
Pressed Pulp	1·15	0·41
Water from presses	0·95	0·17
Water from battery	0·77	0·13

Hence, in Claassen's process, the water from the cossette-process contains 83% of the sugar content of the pressed pulp, whereas in the ordinary process the percentage is only 40. Further, by Claassen's process the pressed pulp weighed 38% of the roots, so that the loss was 0·44% on the roots. By the ordinary diffusion, the pressed pulp weighed 58%; the loss amounting to 0·41% on the roots.

Consequently, the loss of sugar was almost identical in the two cases, and yet I must call your attention to this strange fact, namely,

that the weight of pulp obtained in the new process was 38%, whilst in the ordinary process it was 58%. This is not a clerical error, and I have checked M. Sachs's calculations. The dried pulp, obtained by Claassen's process, was analysed at the agricultural station of Bovin with the following results:—

Water..	7·41
Crude Protein	8·20
Crude Fibre	19·11
Ash..	3·93
Fatty matters	0·33
Undetermined, including from 7 to 8% Sugar	61·02
	100·00
Digestible Albumen	6·10%

This is undoubtedly an excellent cattle food, and considering the large proportion of digestible constituents, its value per 100 kilos is by no means excessive when fixed at from 10 fr. 55 to 11 fr. 15.

In Germany, pulp containing 9% of dry matter is sold at 6 fr. 20 per 1,000 kilos. These 1,000 kilos would yield 100 kilos of dried pulp so that allowing 2 fr. 50 for the cost of drying, there remains a profit of from 1 fr. 85 to 2 fr. 45 per ton of roots.

From the statement made by our Vice-President, M. Pellet, at the Congress of Applied Chemistry at Rome, I understand that the process that he then brought to our notice resembled the process of Dr. Claassen in that the sugar accumulates in the pulp and is thereby lost to the fabricant. M. Pellet informs us that in his process he utilizes the waters from the cossette-presses as well as those which drain off from the diffusers, but that these are first purified by means of lime followed by carbonatation. But this is to add another stage to the manufacturing operations at a time when it is most desirable to diminish the working expenses.

It is true that these waters are purified by his treatment, but in thus removing the dissolved albumen he diminishes the nutritive value of the pulp. I very much doubt whether he obtains a better extraction or a purer diffusion juice by reducing to a minimum the volume drawn off from the battery. I am now entirely in favour of the Claassen and similar processes in which the volume of juice drawn off is considerable (110 litres per 100), the density relatively low (1·056) and the purity averaging about 87·60.

If M. Pellet succeeds in reducing the total diffusion losses to 0·15, whilst the volume of juice drawn off is only 95 litres and is of high density and purity, his process will certainly be of much value in an industry which is already greatly indebted to him.

In connection with this subject, I give the following extract from a very interesting book from the pen of Dr. Hermann, director of the Sucrerie Dormagen, and formerly assistant to Dr. Claassen. "According to a recent statement of K. Steffen, the methods adopted for analysing beets would raise the undetermined losses to between 1·5 and 2·0%; a statement which requires proof and which I, for one, deny.

But during the campaigns of 1901, 1902, and 1903, Dr. Hermann has recorded at the Sucrerie Dormagen total losses of 1·57, 1·50, and 1·23%, with corresponding undetermined losses of 0·87, 0·77, and 0·67%. These figures, recorded by so competent a chemist and approved by Dr. Claassen (who wrote the preface to Dr. Hermann's book), should be remembered as they will be referred to later. Whilst agreeing with Steffen in regarding the methods of analysis defective, I do not mean that the beetroot contains sugar which is concealed from everyone but Steffen himself.

In his remarkable address to the International Congress of Applied Chemistry, held at Rome in 1906, our former president, M. A. Vivien, passing over such trifles as the utilization of waste waters, spoke in high terms of a reversed circulation of the juice, recommending the arrangement patented by M. Léon Holette, of Inchy (which had then been made public).

M. Vivien supported his views by such forcible arguments that our fabricants will do well to consider them carefully, and I therefore reproduce them here. M. Vivien said:—"When it is desired to increase the output of a battery, to double it, for example, it is more usual to double the capacity of the diffusers than to accelerate the working of the battery, so as to double the number of diffusers worked in 24 hours. Under actual working conditions the diffusion is slow, the extraction imperfect, and *the undetermined losses considerable*, because:—

1. The juice, circulating slowly through the mass of beet-slices, tends to flow in whichever direction offers the least resistance, completely extracting the sugar from the cossettes lying in its course whilst leaving the cossettes rich in sugar in those places where the resistance to the circulation of the juice is great.

2. In slow diffusion the juice is left too long in contact with the cossettes at a temperature favourable to fermentative changes such as lactic, butyric, and even alcoholic, as I have proved at one usine last year. Under these conditions there is a destruction of sugar and an increase in undetermined losses.

The numerous fabricants who vainly imagine that by doubling the size of their batteries they are doubling their outputs will profit much

by reading and re-reading M. Vivien's pamphlet. No alteration of a well-constructed battery is necessary in order to reduce the sugar-content of the exhausted cossettes to 0·15 % provided that proper care is taken, and that the volume drawn off be sufficiently reduced to yield a very pure and rich juice.

M. Vivien, who is always careful to quote authorities, will excuse my borrowing another of his statements:—"I consider that in France (I might add in all sugar producing countries save Austria-Hungary) diffusion is conducted too slowly, and this gives rise *to serious alterations* in the sugar undergoing diffusion.

"In my opinion it is a mistake to suppose that a slow diffusion means a good extraction. At the Sucrerie at Inchy under the direction of M. L. Halletta, where the diffusion battery appears to be well designed, an excellent extraction is obtained when from 165 to 185 diffusers are operated during 12 hours."

Here I conclude my quotations from M. Vivien, for a diffusion plant such as this (which treats 360,000 kilos. of roots per day in diffusers of 20 hecto-litres capacity) is but a dream for the fabricant and a nightmare for the constructor who think only of increasing the dimensions of the battery, so that diffusers of 80 hectolitres are now considered "small."

M. Vivien's experience leads to the following conclusion—the extraction becomes more regular when the juice is caused to circulate from below *upwards*, as is done during *meichage* when the usual circulation of the juice is interrupted.

On thus reversing the normal direction of the juice the circulation is greatly improved because the mass of cossettes becomes less compact, and therefore more permeable; so that, instead of 100, it is possible to operate 200 diffusions in two hours. The time during which the juice remains in the battery is thus halved and much of the loss of sugar due to fermentation is avoided when the juice remains in the battery for only 1¼ hours instead of 2½ hours, and might be even further reduced by working at a higher speed. It is in this direction that we must direct our efforts, for I am convinced after a special study of diffusion that it is a mistake to erect batteries of large diffusers since these become so many receptacles for fermentations. And it is because I realize this mistake that I am to-day in favour of the Naudet Process of Rapid Circulation and the Steffen Process in which a most perfect diffusion is realized without any circulation.

(To be continued.)

THE CANADIAN TARIFF.

(Willett & Gray's Circular.)

In view of the change in the duties on sugar imported into Canada, we print below the comparative rates on the standard grades—in cents per pound—under the old and new tariffs:—

	Old Tariff.			New Tariff.		
	British Preferential.	General.		British Preferential.	Intermediate.	General.
	c.	c.		c.	c.	c.
Raw 75° polarization..	·26⅝	·40	..	·34	·45	·52
,, 96° ,, ..	·47⅜	·71½	..	·55	·73	·83½
Refined	·84	1·26	..	·84	1·14	1·26

The following is the new Canadian Tariff schedule effective November 30th, 1906.

There are three tariffs:—British Preferential, Intermediate, and General. The rates of duties are given in this order:—

Schedule A.—Import Duties on Customs.

Group 2.—Sugar, Molasses, and Manufacturers thereof.

134. All sugar above No. 16 Dutch standard in colour, and all refined sugars of whatever kinds, grades, or standards, testing not more than 88° by the polariscope per one hundred pounds, 72c., 98c., $1·08, and for each additional degree over 88° per one hundred pounds, 1c., 1⅓c., 1½c., provided that fractions of five-tenths of a degree or less shall not be subject to duty, and that fractions of more than five-tenths shall be dutiable as a degree. Provided that refined sugar shall be entitled to entry under the British Preferential Tariff upon evidence satisfactory to the Minister of Customs that such refined sugar has been manufactured wholly from raw sugar produced in the British colonies and possessions, and not otherwise.

135. Sugar, n.o.p., not above No. 16 Dutch standard in colour, sugar drainings or pumpings drained in transit, melado or concentrated melado, tank bottoms, sugar concrete, and molasses testing over 56° and not more than 75° by the polariscope, per one hundred pounds, 34c., 45c., 52c., and for each additional degree over 75° per one hundred pounds, 1c., 1⅓c., 1½c. Provided that fractions of five-tenths of a degree or less shall not be subject to duty, and that fractions of more than five-tenths shall be dutiable as a degree. Provided that all raw sugar, including sugar specified in this item, the produce of any British colony or possession, shall be entitled to entry under the British Preferential Tariff, when imported direct into Canada from any British colony or possession.

136. Molasses produced in the process of the manufacture of cane sugar from the juice of the cane without any admixture with any other ingredients, when imported direct from the place of production,

or its shipping port, in the original package in which it was placed at the point of production and not afterwards subjected to any process of treating or mixing, testing by the polariscope not less than 30° nor more than 56°, under regulations prescribed by the Minister of Customs, per gallon, 2½c., 3c.

137. Molasses, testing not more than 56° by the polariscope, the produce of any British country entitled to the benefits of the British Preferential Tariff when produced from sugar cane and imported direct by ship from the country of production, or from any British country, in the original package in which it was placed at the point of production and not afterwards subjected to any process of treating or mixing, provided, however, that the said molasses may be transferred in bond under excise regulations for purposes of distillation, F.

138. Maple sugar and maple syrup, British Preferential Tariff, 15%, 17½%, 20%.

139. Glucose, or grape sugar, glucose syrup and corn syrup, or any syrups containing an admixture thereof, per one hundred pounds, 35c., 45c., 50c.

140. Syrups and molasses, of all kinds, the product of the sugar cane or beet, n.o.p., and all imitations thereof, or substitutes thereof, per one hundred pounds, 35c., 45c., 50c.

141. Sugar candy and confectionery of all kinds, including sweetened gums, candied peel, candied popcorn, candied fruits, candied nuts, flavouring powders, custard powders, jelly powders, sweetmeats, sweetened breads, cakes, pies, puddings, and all confections containing sugar, 22½%, 32½%, 35%.

Intermediate Tariff.—It is understood that the Intermediate Tariff does not apply to sugar at present, but it may be applied from time to time, in case the Government makes certain commercial agreements under the following clause of the tariff:—

(*c*) From time to time, in consideration of benefits satisfactory to the Governor in council, he may extend the benefit of the intermediate tariff, in whole or in part, to any British or foreign country, the produce or manufactures of which have previously been subject to the rates of customs duties set forth in the general tariff, and from and after the publication of such order in the *Canada Gazette*, the rates of duty set forth in the intermediate tariff, so far as they are mentioned in the said order, shall apply to goods the produce or manufacture of such British or foreign country, when imported direct from such foreign country or from a British country, subject to the provisions of these resolutions.

Dumping Clause.—Imports of refined sugars from the United States continue to be practically shut out, in consequence of the retention of the following provision:—

(5) That in case of articles exported to Canada of a class or kind made in Canada, if the export or actual selling price to an importer

in Canada be less than the fair market value of the same article when sold for home consumption in the usual and ordinary course in the country whence exported to Canada at the time of its exportation to Canada, there shall, in addition to the duties otherwise established, be levied, collected and paid on such article, on its importation into Canada, a special duty (or dumping duty) equal to the difference between the said selling price of the article for export and the said fair market value thereof for home consumption;

Provided that the said special duty shall not exceed 15% *ad valorem* in any case;

Provided also that the following goods shall be exempt from such special duty, viz.:—

(A) Goods whereon the duties otherwise established are equal to 50% *ad valorem;*

(B) Goods of a class subject to excise duty in Canada;

(C) Sugar refined in the United Kingdom.

Provided, further, that excise duties shall be disregarded in estimating the market value of goods for the purposes of special duty when the goods are entitled to entry under the British preferential tariff.

Surtax.—Imports of sugar from Germany are still assessed the rates of duty under the general tariff, plus a surtax equal to one-third of same, under the following provisions:—

(6) That articles which are the produce or manufacture of any foreign country which treats imports from Canada less favourably than those from other countries may be subject to a surtax over and above the duties specified in the said schedule A, such surtax in every case to be one-third of the duty specified in the general tariff in the said schedule A.

THE INFLUENCE OF STRIPPING ON THE YIELDS OF CANE AND SUGAR.*

By C. F. Eckart.

(Continued from page 49.)

A discussion of the relative degree in which the various plats responded to the methods of fertilization adopted in the plan of these experiments would be premature at this time. Safe conclusions cannot be drawn from the results yielded by a one-crop test, and it will be necessary to continue this series through a number of cropping periods before proper comparisons can be made. The fallowing and green manuring of the field in which these experiments were conducted placed the land in excellent condition, and the yield of cane

* Abridged from Bulletin No. 16 of Hawaiian Sugar Planters' Association.

and sugar on the unfertilized area approached the maximum limit of production. With succeeding crops the weights of cane harvested from the unfertilized plat will naturally diminish, and the effects of fertilizers on the other plat will become more pronounced.

The results from stripping this first plant cane crop of the series are of particular moment, and while it is essential that further data be obtained in this connection from further tests with ratoons and plant cane, it is also very important that the results already gained be published at this time. The losses from stripping in these several instances appear almost incredible when we grasp their full significance. For instance, if we consider the case of Plat No. 4, which gave the *smallest* loss from stripping (of the fertilized plats) and compare the yields of sugar of the stripped and unstripped cane, the losses from stripping are found to be the following:—1, cost of stripping; 2, cost of fertilizer; 3, value of 3·26 tons of sugar. To this astonishing total must be added still another loss, which though not so immediate is very important, and that is the resulting inferiority of stubble left over for the future ratoon cane.

Having noted the decreased yields of cane and sugar due to the removal of the dried leaves, it will now be of interest to consider the underlying causes in some detail.

In April, 1904, Mr. R. C. L. Perkins, writing of the injury done to cane by the Rind Disease, stated:—

> "This is a wound fungus, and unquestionably it starts in the "punctures made by the leaf-hopper in the cane-stem. . . . "Whole cane fields are simply saturated with the spores of the "fungus, and where a stem is punctured by leaf-hopper one can "only wonder that any escapes infection. . . . It is clear "that countless millions of spores are frequently produced on "one internode of a single stick of cane. What must be done "is clearly to protect the stem as far as possible from the leaf-"hopper, for a stem once infected with the fungus is largely or "altogether ruined. On no account, therefore, *unless it is* "*absolutely necessary for reasons of cultivation*, should cane be "stripped so as to expose joints with the rind still soft, in fields "where leaf-hopper is abundant. If such stripping be made, "the young joints will be freely pierced by the ovipositors "of the female hoppers and give ready access to the parasitic "fungus. I believe, that until the leaf-hopper is subdued by "natural enemies, this is the only really effective manner in "which great loss from the fungus can be avoided. The injury "done to the leaves by the egg-laying of the leaf-hopper is as "nothing to that when the stem is pierced."

In the case of the field under consideration, the leaf-hopper and the rind disease have unquestionably been the most responsible agents in reducing the yields of the stripped cane. Through the rank,

stimulated growth following the application of large quantities of fertilizing material the cane acquired a comparatively soft rind which, on becoming exposed through the removal of the dried leaf sheaths, offered an attractive field for the egg-laying of the hoppers. The hopper punctures gave ready access to the spores of the rind fungus and hundreds of dead canes bore evidence of the results. While the unstripped cane also suffered from these pests of the field, their injuries were comparatively small, and the numbers of dead canes left in the rows were considerably less. The great majority of dead cane stalks showed the presence of the rind fungus in the stripped and unstripped sections. The fact that the stripped unfertilized cane gave a slightly better yield than the unstripped unfertilized cane indicates that where the cane was permitted to make an unstimulated growth, with a resulting firmer rind, the conditions in general favoured stripping, though hardly to a degree which would be compatible with economy.

In this series of tests all of the plats were laid out on the leeward side of an adjacent field. While the stripped and unstripped rows in each plat had practically the same exposure to the prevailing winds, the shelter afforded by the field to windward doubtless influenced the results to a very considerable extent and served to increase the losses from stripping for two reasons.

1.—Leaf-hoppers are known to frequent the more sheltered parts of a field in preference to the exposed parts.

2.—In this sheltered locality it is reasonable to suppose that the soft internodes of the cane stalk, exposed by the removal of the leaf sheaths, would harden more slowly than would be the case if they were subjected to the force of the prevailing winds. They would, therefore, present a suitable surface for the leaf-hoppers in their egg-laying activities for a longer period.

The stripped row of the unfertilized plat was slightly more exposed than the stripped rows of the other plats, and a certain small allowance should be made for this fact.

In stripping, large numbers of leaves which are still performing their functions are often removed. The injuries from this too-high stripping are two-fold. The cane not only receives a certain check in growth as a consequence, but it has been pointed out by Dr. Cobb that the removal of the green leaves is usually effected at the expense of a portion of the rind, and an abrased area is left on the surface of the cane stalk to furnish ready access to the ever present spores of the rind disease. If plantation labourers were more moderate in their zeal and left a couple of the dried leaves on instead of taking one or two of the green ones off, this cause of loss would be eliminated.

Third Series.

The second series of tests, as has been stated, were conducted in a locality where the plats were sheltered from the prevailing winds. In

a third series of experiments the stripped cane was more exposed to the force of the wind than the unstripped cane, the latter having been to the leeward of the former.

Lahaina cane was planted in the plats in June, 1904, and the experiments were harvested in March, 1906. While they were carried out in a different part of the field from the second series of stripping tests and were much more exposed to the wind, the other climatic influences to which they were subjected were precisely the same.

The most interesting points which may be noted with respect to the data in this series are:—

1.—The juices of the stripped cane were of better quality than the juices of the unstripped cane. How much this was due to the fact that the unstripped cane was less exposed (with regard to location), than the stripped cane we are unable to state, although the difference may with reason be largely attributed to this cause.

2.—The percentage of fibre was higher in the unstripped cane than in the stripped cane.

3.—In Experiment No. 1 there was a loss of 10·4 per cent. on the weight of cane due to stripping and a loss on weight of sugar amounting to 7·3 per cent. In Experiment No. 2 the loss from stripping was 12·7 per cent. on the weight of cane and 10·2 per cent. on the weight of sugar.

The data yielded by the stripping tests here described lead us to at least one very definite and important conclusion. It is strikingly evident that careful field experiments should be carried out on the plantations to determine the economy in removing the dried leaves from the cane. The universal and simultaneous presence of the leaf-hopper pest and the rind disease in Hawaiian cane fields has created conditions which warrant careful investigations with regard to stripping not only on different plantations, but on different parts of the same plantation. The fact that one-half of a plantation may be stripped with profit is not always a guarantee that the other half will not be stripped at a loss, especially where the lands are characterized by an uneven surface with its exposed hills and sheltered depressions and where the fields are liberally fertilized.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Applications.

29211. B. E. R. Newlands and J. J. Eastick, London. *Manufacture and purification of invert sugar.* 22nd December, 1906.

660. H. W. Aitken and W. Mackie, Glasgow. *Improved roll for sugar cane mills.* 10th January, 1907.

ABRIDGMENT.

26264. H. Noffke, Berlin, Germany. *Improvements in saccharometers.* 16th December, 1905. This invention relates to a saccharometer characterized by the fact that one arm of a U-shaped tube, the lower part of which is filled with mercury, is provided with a suitable scale whilst the other arm opens out into a vessel, the neck of which is bored on one side and which is closed by a grooved glass stopper of the kind used for dropping vessels, this stopper being provided at its upper part with a plate adapted for the reception of a weight.

GERMAN.—Abridgments.

13217. E. A. Barbet, Paris, France. *Process of desulphurizing saccharine fruit juices.* 7th June, 1906. This invention relates to a process of desulphurizing sugared (sweet) fruit juices, whatever may be their nature, by causing them to pass through the interior of vertical tubes wherein they become heated before continuing their ascent to the top of a column composed of several superposed plates each provided with caps for baffling or with small holes, and an overflow, which process consists in causing the said juices to descend from the first to the last of the said plates, whilst they undergo a violent ebullition in a regular manner, then to a heater wherein at a minimum temperature of 60° C. they are brought into the presence of atmospheric air, the entrance of which through a valve is accelerated by the exhaustion of an air pump which produces a vacuum of about one-fifth to one-third of an atmosphere in order that during the desulphurization there may be drawn in at the top of the said column sulphurous acid, the vapours occupying the said column and air charged with volatile products which products are condensed whilst the desulphurized juices still boiling are directed into a cooler, and then towards the fermenting trough.

174624. W. H. Uhland G.m.b.H., of Leipzig, Gohlis. *Process for moistening dextrine.* 22nd July, 1905. The dextrine is drawn in the form of a thin zigzag-shaped band against a current of moist air flowing in an opposite direction through a shaft provided with stepped projections.

175341. A. Wernicke Maschinenbau-Akt.-Ges., of Halle-on-Saale. *A bearing for centrifugals provided with a buffered collar bearing in the interior of the trunk.* 15th November, 1904. This bearing is characterized by the bush of the neck of the bearing being prolonged upwards and here again elastically mounted.

175759. Bromberger Maschinenbau-Anstalt G.m.b.H., of Prinzenthal. *Arrangement for automatically opening and closing sludge discharge valves in beetroot washers.* 26th November, 1905. This apparatus for the automatic opening and closing of sludge discharge valves in beetroot washing apparatus has drawbars connected by means of a rope, chain or the like with the levers of

the dirty water valves, and arranged in a circle, which drawbars are successively lowered by means of a central rod moving up and down and adapted to be vertically displaced by a catch device and raised by the action of counterweights, the said catch device being adapted to be fixed at a suitable height on the centre rod and the latter being caused to describe in known manner by means of a rachet wheel and pawl a periodic progressive rotary movement.

176087. THE FIRM OF FR. MEYER'S SOHN, of Tangermünde. *Sugar ejector for centrifugals.* 7th February, 1906. This is composed of several segmental bent pieces or stirrups provided with handles, and another stirrup also segmental, and provided with a handle and a cutting device or scraper, which for the purpose of throwing down or ejecting the sugar layer may be drawn out of it and under it respectively.

176174. HERM. HILLIBRAND, of Werdohl, Westphalia. *Shreddings knife for sugar-beet shredding machines.* 21st February, 1906. In this arrangement the angles of the cover pieces of the cutting blades are always smaller on the side on which the sharpening for forming the cutting edge is effected than on the other side, that is to say the thickness of the cover walls in one knife sharpened from below increases towards the point of the cover, whilst in another knife which is sharpened from above, it decreases.

176931. GÖHRING & HEBENSTREIT, of Dresden A. *Process and apparatus for moistening dextrine and the like.* 8th March, 1906. This invention relates to a process for moistening dextrine and the like, in which air is conveyed above or through the material, which is kept in movement, which air is saturated with steam at a temperature exceeding the temperature of the material, and consequently gives off water to the material. Another method of carrying out this process consists in the material which has become deleteriously heated by the treatment hereinbefore described being cooled by means of cooler moist air.

WEEKLY STATEMENT OF COMPARATIVE

For the Fifty-two weeks of 1906 compared

	German Beetroot 88 o/o Prompt, free on board.						French Crystals. No. 3. c.f.i.			Java afloat. No. 15 and 16.		
	1906.		1905.		1904.		1906.	1905.	1904.	1906.	1905.	1904.
Jan. 5..	8/1½	8/2¼	14/5	15/1½	8/4¾	8/3½	10/2¼	--	10/1½	9/1½	15/10½	9/3
12..	8/2¼	8/3	15/1½	15/11¾	8/3½	8/1	10/2¼	—	10/-	9/3	16/10½	9/1½
19..	8/3	8/2½	15/11¾	16/0¾	8/1	7/10¼	10/3	—	10/-	9/1½	17/3	8/9
26..	8/2½	8/2	16/0¾	16/-	7/10¼	7/10¼	10/2¼	—	9/10½	9/1½	17/1½	8/7½
Feb. 2..	8/2	7/11½	16/-	15/6½	7/10¼	7/9½	10/-	—	9/6	9/-	16/10½	8/4½
9..	7/11½	8/-	15/6½	15/2	7/9½	7/9	10/0¾	—	9/6	9/-	16/7½	8/6
16..	8/-	8/0½	15/2	15/1½	7/9	7/11	10/1½	—	9/7½	9/-	16/-	8/7½
23..	8/0½	8/2	15/1½	15/4½	7/11	8/0	10/3	—	9/9	9/1½	16/-	8/7½
March 2.	8/2	8/3	15/4½	15/3¼	8/0	8/2½	10/5¼	17/-	9/9¾	9/1½	16/-	8/7½
9..	8/3	8/3¾	15/3¼	15/-	8/2½	8/3	10/6	16/9	9/10½	9/1½	15/10½	8/10½
16..	8/3¾	8/5	15/-	14/7¾	8/3	8/3½	10/7½	16/6	10/-	9/3	15/7½	8/10½
23..	8/5	8/4½	14/7¾	14/5¼	8/3¼	8/5½	10/9	16/6	10/2¼	9/6	15/4½	9/1½
30..	8/4½	8/4¼	14/5¼	14/6½	8/5½	8/6½	10/6¾	16/6	10/4½	9/6	15/3	9/3½
April 6..	8/4¼	8/5¼	14/6½	14/5¼	8/6½	8/6	10/9	16/6	10/4½	9/6	15/3	9/4¼
13..	8/5¼	8/6	14/5½	14/0¼	8 6	8/5½	10/10½	16/6	10/8¾	9/6	15/4½	9/5¼
20..	8/6	8/4¾	14/0¼	13/1¼	8/5½	8/7½	10/9	16/6	10/6¾	9/4½	14/10½	9/5¼
27..	8/4¼	8/4¼	13/1½	12/9¾	8/7½	8/9½	10/9	Nom.	10/9	9/4½	14/6	9/8
May 4..	8/4¼	8/2¾	12/9¾	12/1½	8/9½	8/11½	10/7½	Nom.	10/11¼	9/3	14/6	9/9
11..	8/2¾	8/1½	12/1½	11/10	8/11½	9/2	10/7½	Nom.	11/2¼	9/2¼	13/9	10/3
18..	8/1½	7/11	11/10¼	11/8¼	9/2	9/6½	10/4½	Nom.	11/3	9/0¾	13/6	10/4½
25..	7/11	7/10¾	11/8	11/11½	9/6½	9/4¼	10/3	Nom.	11/6¾	8/11¼	13/6	10/4½
June 1..	7/10¾	8/-	11/11½	11/9¾	9/4¼	9/2	10/6	Nom.	11/4½	8/11¼	13/3	10/6
8..	8/-	8/0½	11/9¾	11/11½	9/2	9/0½	10/6	Nom.	11/2¼	9/-	13/3	10/5¼
15..	8/0½	8/3	11/11½	11/9¾	9/0½	9/1¼	10/8¼	Nom.	11/3¾	9/3	13/3	10/3
22..	8/3	8/2	11/9¾	11/9½	9/1¼	9/3	10/6	Nom.	11/3	9/4½	13/1½	10/3
29..	8/2	8/2¾	11/9½	10/11¼	9/3	9/4¼	10/6¾	Nom.	11/3	9/6	12/10½	10/3
July 6..	8/2¼	8/5	10/11¼	10/6	9/4¼	9/7¼	10/9¾	Nom.	11/3¾	9/6	12/9	10/6
13..	8/5	8/4¼	10/6	10/2½	9/7¼	9/8	10/8¼	Nom.	11/3¾	9/6	11/9	10/6
20..	8/4¼	8/6	10/2½	10/11½	9/8	9/8½	10/9	Nom.	11/4½	9/6	11/9	10/6
27..	8/6	8/7	10/11¼	11/-	9/8½	9/9½	10/9¾	Nom.	11/4½	9/7½	11/9	10/[illegible]
Aug. 3..	8/7	8/9½	11/-	10/6	9/9½	10/1¼	11/-	Nom.	11/8¼	9/9	11/6	11/-
10..	8/9½	8/11½	10/6	10/1½	10/1¼	10/5¾	11/1½	Nom.	11/9¾	10/-	11/6	11/8
17..	8/11½	9/0½	10/0½	9/5	10/5¾	10/6	11/1½	Nom.	12/0	10/-	11/6	11/3
24..	9/0½	9/5½	9/5	9/1½	10/6	10/6½	11/3	11/3	12/0	10/1½	11/-	11/1½
31..	9/5½	9/5	9/1½	8/9	10/6½	10/8	11/5¼	10/7½	12/1½	10/3	10/3	11/7½
Sept. 7..	9/5	9/6¾	8/9	8/7	10/8	10/7½	11/6¾	10/7½	12/2¼	10/4½	10/3	11/9
14..	9/6¼	10/2	8/7	8/5½	10/7½	10/6	12/-	10/5¼	12/1½	10/9	10/0	11/9
21..	10/2	9/7½	8/5½	8/8	10/6	11/0	11/10½	10/6¾	12/10½	10/10½	9/9	11/1[illegible]
28..	9/7½	9/9	8/8	8/7½	11/0	11/2	11/10½	10/7½	13/-	11/-	9/9	12/4½
Oct. 5..	9/9	9/3½	8/7½	8/9½	11/2	11/1¼	11/10½	10/6	Nom.	10/10½	9/9	12/3
12..	9/9	9/5¼	8/9½	8/8¼	11/1¼	10/11¼	11/7½	10/6	—	10/10½	9/7½	12/3
19..	9/5¼	9/4½	8/8¼	8/4¼	10/11¼	11/-	11/7½	10/0¾	—	10/10½	9/7½	12/3
26..	9/4¼	8/11	8/4¼	8/3	11/-	11/1½	11/3	10/-	—	10/9	9/1½	12/4½
Nov. 2..	8/11	8/7	8/3	8/0¼	11/1½	12/10¼	11/-	9/7½	—	10/4½	9/-	13/3
9..	8/7	8/9¼	8/0¼	8/0½	12/10¾	13/9	11/3	9/8¼	—	10/7½	9/-	14/3
16..	8/9¼	8/9½	8/0½	8/2½	13/9	14/1	11/3	10/-	—	10/6	9/-	15/3
23..	8/9½	8/9½	8/2½	8/5¼	14/1	14/0½	11/3	10/4½	—	10/4½	9/3	15/3
30..	8/9½	9/0½	8/5¼	8/3	14/0½	14/1	11/3	10/-	—	10/4½	9/3	15/4½
Dec. 7..	9/0½	9/1	8/3	8/3½	14/1	14/5	Nom.	10/3	—	10/4½	9/3	11/4½
14..	9/1	8/8¾	8/3½	8/2	14/5	13/9¾	,,	10/0¾	—	10/4½	9/3	11/4½
21..	8/8¾	8/11	8/2	8/1½	13/9¾	14/2½	,,	10/0¾	—	10/4½	9/3	11/4½
28..	8/11	8/10	8/1½	8/1½	14/2½	14/5	,,	10/-	—	10/4½	9/1½	15/4½

PRICES OF RAW AND REFINED SUGAR,

with those of the two previous years.

	Tate's Cubes. No. 1.			Tate's Cubes. No. 2.			First Marks German Granulated f. o. b.			Say's Cubes f. o. b.			German & Austrian † Cubes f. o. b.		
	1906.	1905.	1904.	1906.	1905.	1904.	1906.	1905.	1904.	1906.	1905.	1904.	1906.	1905.	1904.
Jan. 5..	18/7½	24/7½	17/10½	17/10½	22/10½	17/4½	10/1½	16/7½	10/4½	12/6	19/6	12/3	11/10½	18/7½	11/10½
12..	18/7½	25/7½	17/10½	17/10½	24/10½	17/4½	10/3	17/6¼	10/1½	12/6	20/-	12/3	11/10½	19/6	11/9
19..	18/4½	25/10½	17/9	17/7½	25/1½	17/3	10/3	17/9¼	9/11¼	12/6	20/-	12/3	11/9	19/7½	11/7½
26..	18/4½	25/10½	17/9	17/7½	25/1½	17/3	10/2¼	17/9	10/-	12/3	20/3	12/3	11/7½	19/6	11/6
Feb. 2..	18/4½	25/10½	17/7½	17/7½	25/1½	17/-	10/-	17/5¼	9/10½	12/3	20/3	12/3	11/7½	19/6	11/3
9..	18/1½	25/7½	17/7½	17/4½	24/10½	16/10½	10/0¼	16/11¼	9/9	12/3	20/-	12/3	11/7½	19/6	11/3
16..	18/1½	25/1½	17/7½	17/4½	24/1½	16/10½	10/0¾	16/10½	10/-	12/3	20/-	12/3	11/7½	19/3	11/4½
23..	18/1½	25/1½	17/9	17/4½	24/4½	16/10½	10/3	17/1½	10/0¾	12/3	19/6	12/-	11/9	19/3	11/4½
March 2..	18/4½	25/-	17/9	17/6	24/3	16/10½	10/3¾	16/10½	10/2¼	12/3	19/6	12/-	11/10½	19/3	11/6
9..	18/6	25/-	17/10	17/7½	24/3	16/10½	10/3	16/6	10/3	12/6	19/-	12/3	11/10½	19/3	11/6
16..	18/7½	24/9	18/-	17/9	24/-	17/-	10/5¼	16/4½	10/3¾	12/9	18/9	11/9	12/-	19/-	11/6
23..	18/9	24/6	18/1½	17/10½	23/9	17/1½	10/6	16/1½	10/5¼	12/9	18/9	12/-	12/1½	18/7½	11/9
30..	18/9	24/6	18/1½	17/9	23/9	17/1½	10/5¼	16/3	10/6	12/6	18/9	12/-	12/1½	18/6	11/9
April 6..	18/9	24/6	18/3	17/9	23/9	17/3	10/6	16/3	10/5¼	12/6	18/9	12/3	12/3	18/6	11/9
13..	18/9	24/6	18/3	17/10½	23/9	17/3	10/9	15/10½	10/4½	12/6	18/9	12/3	12/3	18/6	11/9
20..	18/9	24/-	18/4½	17/10½	23/3	17/4½	10/7½	15/1½	10/6¾	12/6	18/9	12/3	12/3	18/6	11/9
27..	18/7½	23/6	18/7½	17/7½	22/9	17/7½	10/6¾	14/9	10/9	12/6	18/-	12/6	12/-	17/6	12/1½
May 4..	18/4½	23/3	18/7½	17/4½	22/6	17/7½	10/5¼	14/3¾	10/9¾	12/6	18/-	12/6	12/-	17/-	12/1½
11..	18/4½	22/9	18/10½	17/4½	22/-	17/10½	10/3¼	13/10½	11/-	12/6	17/-	13/3	11/10	16/6	12/4½
18..	18/4½	22/-	19/1½	17/4½	21/3	18/1½	10/3	13/6¾	11/4½	12/6	16/6	13/6	11/9	16/-	12/7½
25..	18/1½	22/4½	19/3	17/1½	21/7½	18/3	10/2¼	14/-	11/3	12/6	16/6	13/9	11/7½	16/1½	12/9
June 1..	18/1½	22/4½	19/3	17/1½	21/7½	18/3	10/3¾	13/11¼	11/0¾	12/6	16/6	13/9	11/7½	16/1½	12/9
8..	18/1½	22/7½	18/10½	17/1½	21/10½	17/10½	10/4½	14/2¼	11/-	12/6	16/6	13/9	11/7½	16/3	12/9
15..	18/4½	22/7½	18/10½	17/4½	21/10½	17/10½	10/7½	14/0¾	11/1½	12/6	16/6	13/6	11/10½	16/1½	12/9
22..	18/4½	22/4½	18/9	17/4½	21/7½	17/9	10/5¼	14/0¾	11/-	12/6	16/3	13/6	11/10½	16/-	12/7½
29..	18/6	21/10½	18/9	17/6	21/7½	17/9	10/5¼	13/3	11/2¼	12/6	16/3	13/-	11/7½	15/6	12/7½
July 6..	18/6	21/4½	18/9	17/6	20/7½	17/9	10/7½	12/9	11/4½	12/9	16/3	13/-	11/10½	15/-	12/10½
13..	18/6	21/4½	19/-	17/6	20/7½	18/-	10/5¼	12/-	11/6	12/9	15/9	13/3	11/10½	15/3	13/-
20..	18/7½	21/7½	19/3	17/7½	20/10½	18/3	10/7½	12/10½	11/6¾	12/9	15/9	13/6	11/10½	15/3	13/1½
27..	18/9	21/7½	19/6	17/9	20/10½	18/7½	10/8¼	12/10½	11/9¾	13/-	15/9	13/6	12/-	15/3	13/4½
Aug. 3..	19/-	21/4½	19/7½	18/-	20/7½	18/10½	11/-	12/7½	12/1½	13/-	15/9	13/9	12/1½	14/10½	13/7½
10..	19/3	21/4½	20/-	18/3	20/7½	19/3	11/2¼	12/6¾	12/2¼	13/3	15/-	14/3	12/3	14/10½	14/-
17..	19/1½	21/1½	20/-	18/1½	20/4½	19/3	11/2¼	12/0¾	12/3	13/3	15/-	14/3	12/3	14/7½	11/1½
24..	19/-	21/4½	20/-	18/-	19/7½	19/3	11/7½	11/8½	12/4½	13/6	14/6	14/3	12/6	14/3	14/1½
31..	19/1½	19/10½	20/1½	18/1½	19/1½	19/4½	11/6	11/4½	12/6¾	13/9	14/3	14/3	12/9	14/-	14/4½
Sept. 7..	19/4½	19/10½	20/4½	18/4½	19/1½	19/7½	11/8¼	11/3	12/6¾	13/9	14/3	14/3	13/-	14/-	14/4½
14..	20/-	19/10½	20/4½	19/-	19/1½	19/7½	12/2¼	11/1½	12/6	14/3	14/3	14/3	13/6	13/6	14/4½
21..	19/10½	19/10½	20/7½	18/10½	19/1½	20/-	11/9¾	12/1½	13/3	14/6	14/3	14/9	13/1½	13/3	14/10
28..	19/10½	19/10½	20/10½	18/10½	19/1½	20/3	11/11¼	11/9	13/3¾	14/6	13/9	15/-	13/1½	13/6	15/-
Oct. 5..	19/7½	19/10½	20/10½	18/7½	19/1½	20/3	11/6	11/4½	12/10½	14/6	13/9	15/-	12/10½	13/6	15/-
12..	19/4½	19/10½	20/10½	18/4½	19/1½	20/3	11/5¼	10/10½	12/9	14/6	13/9	15/-	12/10½	13/6	15/1½
19..	19/6	19/10½	21/-	18/6	19/1½	20/4½	11/5¼	10/3	12/10½	14/-	13/9	15/-	12/10½	12/9	15/1½
26..	19/-	19/4½	21/-	18/-	18/7½	20/4½	10/9¾	10/2¼	13/-	14/-	13/6	15/-	12/7½	12/9	15/1½
Nov. 2..	18/9	19/1½	22/1½	17/9	18/4½	21/7½	10/4½	9/9¾	14/4½	13/9	13/-	16/3	12/4½	12/-	16/6
9..	18/9	19/1½	23/6	17/9	18/4½	22/9	10/6	9/9¾	15/0¾	13/9	12/6	17/3	12/6	12/-	16/10½
16..	18/10½	18/7½	23/10½	17/10½	17/10½	23/1½	10/5¼	9/11¼	15/6	13/6	12/6	18/-	12/6	11/9	17/10½
23..	18/9	18/10½	23/10½	17/9	18/1½	23/1½	10/6	10/4¼	15/6	13/3	13/-	18/-	12/4½	12/3	17/10½
30..	18/9	18/10½	23/10½	17/9	18/1½	23/1½	10/9	10/1½	15/6	13/3	13/-	18/-	12/7½	12/3	18/-
Dec. 7..	19/-	18/10½	24/1½	18/-	18/1½	23/4½	10/9	10/1½	15/11¼	13/3	12/9	20/-	12/7½	12/-	18/-
14..	18/9	18/10½	24/1½	17/9	18/1½	23/4½	10/5¼	10/0¾	15/6	13/-	12/9	20/-	12/6	12/-	18/-
21..	18/9	18/7½	24/1½	17/9	17/10½	23/4½	10/6¾	10/-	15/9¾	13/-	12/9	19/-	12/9	11/9	18/-
28..	18/10½	18/7½	24/1½	17/10½	17/10½	23/4½	10/8¼	9/11¼	16/-	13/-	12/6	19/-	12/9	11/10½	18/-

† Basis average Hansa FKL FMS.

H. H. Hancock & Co., 39, Mincing Lane, London, E.C.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM

To end of December, 1905 and 1906.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1905. Cwts.	1906. Cwts.	1905. £	1906. £
Germany	5,860,291	8,812,757	3,124,498	3,862,184
Holland	203,667	521,946	113,800	245,141
Belgium	1,054,896	1,257,960	554,225	571,828
France	729,031	250,901	379,181	110,737
Austria-Hungary	441,675	245,097	273,737	102,472
Java	2,446,841	357,775	1,548,660	174,522
Philippine Islands	9,023	....	4,840	....
Cuba	....	111,885	....	41,943
Peru	1,137,731	537,120	719,621	243,129
Brazil	172,507	994,057	80,634	391,296
Argentine Republic	....	....	....	....
Mauritius	173,477	126,741	93,255	48,362
British East Indies	256,180	146,713	143,662	60,570
Straits Settlements	201,216	104,750	106,383	41,720
Br. W. Indies, Guiana, &c.	1,198,575	1,584,613	903,392	850,003
Other Countries	771,538	196,597	512,989	91,542
Total Raw Sugars	14,656,648	15,248,912	8,558,877	6,835,449
Refined Sugars.				
Germany	9,820,556	12,466,259	7,363,587	7,137,607
Holland	1,777,786	2,829,083	1,361,587	1,718,965
Belgium	313,015	557,107	231,587	326,543
France	2,439,501	2,250,005	1,672,872	1,278,143
Other Countries	344,943	5,378	283,301	3,102
Total Refined Sugars	14,695,801	18,107,832	10,912,934	10,464,360
Molasses	2,537,999	2,655,471	502,324	517,616
Total Imports	31,890,448	36,012,215	19,974,135	17,817,425

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	1,093	377	531	257
Norway	21,912	17,396	15,783	10,373
Denmark	98,577	94,582	64,976	47,929
Holland	83,374	80,410	61,619	49,831
Belgium	10,438	11,055	6,566	6,479
Portugal, Azores, &c.	17,954	30,621	12,251	16,723
Italy	19,160	34,196	11,179	17,274
Other Countries	394,886	628,708	319,423	412,803
	647,394	897,345	492,328	561,669
Foreign & Colonial Sugars				
Refined and Candy	23,775	33,613	20,087	21,303
Unrefined	113,522	161,840	73,060	83,031
Molasses	2,909	6,322	926	1,979
Total Exports	787,600	1,099,120	586,401	667,982

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to Jan. 17th ..	66,700	..	24,216
Receipts of Refined ,, ,, ...	Nil.	..	100
Deliveries ,, ,, ...	61,257	..	59,801
Consumption (4 Ports, Exports deducted) since January 1st..	53,865	..	57,350
Importers' Stocks, January 16th	5,443	..	31,948
Total Stocks, January 23rd	144,000	..	138,210
Stocks in Cuba, ,, ...	102,000	..	31,040
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1905 AND 1906.

(Tons of 2,240lbs.)	1904-05. Tons.		1905-06. Tons.
Exports	1,044,430	..	1,150,466
Stocks	73,668	..	903
	1,118,098	..	1,151,369
Local Consumption (twelve months)..	45,160	..	46,830
	1,163,258	..	1,198,199
Stock on 1st January (old crop)	—	..	19,450
Total Receipts	1,163,258	..	1,178,749

Havana, November 30th, 1906. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR TWELVE MONTHS ENDING DECEMBER 31ST.

SUGAR.	Imports. 1904. Tons.	1905. Tons.	1906. Tons.	Exports (Foreign). 1904. Tons.	1905. Tons.	1906. Tons.
Refined	880,275	734,790	905,392	1,189	1,188	1,681
Raw	734,197	732,832	762,445	5,044	5,676	8,092
Molasses	97,110	126,900	132,774	131	145	316
Total	1,711,582	1,594,522	1,800,611	6,364	7,009	10,089

	Home Consumption. 1904. Tons.	1905. Tons.	1906. Tons.
Refined	873,191	731,775	873,620
Refined (in Bond) in the United Kingdom	529,804	552,097	539,760
Raw	119,105	101,599	114,753
Molasses	90,409	124,058	128,482
Molasses, manufactured (in Bond) in U.K.	60,779	57,444	62,475
Total	1,673,288	1,566,973	1,719,090
Less Exports of British Refined	29,423	32,369	44,867
Total Home Consumption of Sugar	1,643,865	1,534,604	1,674,223

Stocks of Sugar in Europe at uneven dates, Jan. 1st to 19th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1907.
144	1409	835	835	288	3510

	1906.	1905.	1904.	1903.
Totals	3856	2737	3614	3369

Twelve Months' Consumption of Sugar in Europe for Three Years, ending December 31st, in thousands of tons.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906.	Total 1905.	Total 1904.
1827	1203	640	547	194	4411	3798	4217

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.	1903-1904. Tons.
Germany	2,250,000	2,415,136	1,598,164	1,927,681
Austria	1,335,000	1,509,870	889,373	1,167,959
France	755,000	1,089,684	622,422	804,308
Russia	1,450,000	968,000	953,626	1,206,907
Belgium	280,000	328,770	176,466	209,811
Holland	190,000	207,189	136,551	123,551
Other Countries	430,000	415,000	332,098	441,116
	6,690,000	6,933,649	4,708,758	5,881,333

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTES AND COMMENTS.

Sugar Prices and the Brussels Convention.

We quoted a passage from an article in the *Greenock Telegraph* last month, on "Sugar Refining in Greenock in 1906," which very clearly demonstrated that the Convention had not raised the price of sugar. Unfortunately a printer's error rather spoilt the force of one passage. Lines 11 to 15 on page 67 should have run as follows:—

> "The price of the sugar is, therefore, fully 2s. per cwt. cheaper in 1906 than in 1896, which latter may be taken as a normal year before the imposition of the duty and before the abolition of the bounties by the Convention. But, again, take the year 1898, during which sugar was at its lowest point previous to the imposition of the duty. The average price of "Neill's Tops" was 12s. 6d. in that year, or, deducting 4d. for discount, the net price was 12s. 2d., or 8d. per cwt. over the price of 1906."

Patent Law Reforms.

It comes rather as a surprise to find a member of the present Free Trade Government advocating reform on lines which, however disguised, represent nevertheless the thin end of the wedge of Protection. However much Mr. Lloyd-George may protest to the contrary, the fact remains that his new measure of Patent Law reform, to be introduced this session, is of a nature to meet with the

hearty approval of all tariff reformers. A crying need will be met and British manufacturers will be relieved of an injustice which has long burdened them. Hitherto it has been the practice for foreigners who have devised a valuable patent in their own country, to secure the British patent rights as a matter of course, and then to work them in their own country and dump the finished products on our markets, without giving an iota of work to British manufacturers. Under the proposed new law, it will be necessary for foreigners, who take out a British patent, to work it in the United Kingdom, so that they will have either to erect works in this country or else to grant manufacturing licences to any British firms who may desire to have them. This is a step in the right direction, and we congratulate Mr. Lloyd-George on his courage and enterprise in introducing such a measure.

Some Advantages of the Brussels Convention.

In a recent issue of the *Glasgow Herald* the Brussels Convention was the subject of an interesting leader. Prefacing its remarks by the statement that a bold effort is about to be made to induce the Government to give notice of withdrawal from the Convention, our contemporary went on to show how little the Convention has really affected the flow of sugar into the United Kingdom. On the other hand, the leader writer is naturally in a good position to gauge the advantages which have ensued to trade in the Glasgow district as a result of the abolition of bounties, and he is definite in his information on this point—the engineering and refining trades have all experienced a large increase in business. But still more important at the moment is his allegation that the possibility of the Convention being terminated is already having an adverse effect, as the following quotation from the leader in question will show:—

Prior to the Convention the importation of West India sugar into the Clyde was practically stopped by the flood of beetroot, but now the Greenock refiners are taking cane instead of beet sugar, and last year they imported some 21,130 tons from the West Indies, as compared with only 965 tons in 1902. There are now five refineries at work in Greenock, and last year the consumption of raw sugar there was 44,739 tons more than in 1905 and 60,000 tons more than in 1902. The West Indian Colonies are now able to send their sugar to us instead of being dependent on the United States, from which market they are being gradually shut out by the enlargement of American and Cuban supplies. Now, the improvement of the market for cane sugar since 1902 has caused the sugar Colonies to set their house in order. One of the immediate results was the erection of the first central factory in Antigua, the machinery for which was sent from Glasgow, and which has been in successful operation since 1904. We are told that the intention was to double this factory in the course of the present year, but that in view of the proposals to terminate the Convention these extensions have been arrested. For the same reason operations on a projected new

factory in St. Kitts have this year also been suspended. During the ten years of bounties prior to the Convention orders for sugar factories practically ceased to come to this district at all; within the past four years the orders have been numerous, exceeding over a million sterling and giving large employment to labour. Since the Convention every one of our sugar plant engineers has been actively employed with business that, but for the Convention, would not have come to this country at all.

We hope the present Government will carefully ponder these facts before committing themselves to a disastrous policy of retreat.

Sugar Growing in Formosa.

It appears that there are at present three sugar refining companies in Japan—the Tokio and the Osaka sugar refining companies which have recently been incorporated, and the Dairi Sugar Refining Company. Two new companies are, however, being formed in Yokohama and Nagoya. Save for what sugar they can get from Formosa, all these companies have to look to Java for their supply of raw sugar. This being so, it is not surprising to learn that the Japanese Government are making every effort to encourage the Formosan sugar industry. Quite a number of new companies have been formed in that Island for producing raw sugar, and they are in receipt of substantial subsidies from the Formosa Government in accordance with the Sugar Industry Encouragement Regulations, as well as a certain immunity in respect of the tax on sugar. But as the demand for raw sugar in Japan is about 250,000 piculs per month (15,200 tons), all the new companies and mills projected in Formosa when put in full operation will scarcely be able to meet that demand.

Chambers of Agriculture on Beet Growing.

At a recent meeting of the Council of the Associated Chambers of Agriculture, a discussion took place on the growing of sugar beet in the United Kingdom and on the Sugar Convention; a resolution adjourned from the previous meeting was further discussed. It was to this effect:—" This Council hopes that the Government will give its attention to the growth of sugar beet in the United Kingdom, and that it will support the Sugar Convention." To quote the *Times* report:—

Captain Pretyman spoke of satisfactory results which had been attained from the growing of sugar beet in East Suffolk, and maintained that on ordinary agricultural land in England sugar beet could be grown equal to that grown in Germany. It could not be denied, he said, that this industry had prospered abroad, where 50 million tons of roots, representing the cultivation of 4 million acres, were grown annually. What they required in this country was that some slight advantage should be given, in the matter of Excise, as against the export duty, to an experimental factory for a definite period of about five years, and that it should be the policy of any

Government in this country to defend or protect them against any foreign bounties. The chamber could do a great service to agriculture by pointing out that in sugar beet they had an industry which would compete with no existing industry in this country.

Mr. W. J. Lobjoit (Middlesex) moved as an amendment that all words after "United Kingdom" should be struck out.

Mr. E. M. Nunneley (Northampton) seconded.

Lord Denbigh maintained that it was useless to ask people to put down a large sum of money for a sugar factory unless they were going to give them some support against the re-imposition of foreign bounties. He suggested the addition to the resolution of the words "in so far as the Convention relates to the prevention of sugar bounties."

Mr. Martin J. Sutton said that he was represented in *The Times* that day as having recommended farmers to grow sugar beet. He believed that farmers could grow it; but he thought that they should not do so until they were quite sure of there being a market for their roots.

Mr. Francis urged that a new industry should not be introduced into this country, as it would diminish the growing of wheat and food for the people.

After further discussion the amendment was carried.

Another amendment moved by Colonel Williams, M.P., that the words "and will take whatever steps are necessary to encourage a new industry" should be added, was lost.

On the motion of Mr. Wood Homer, it was agreed that the following words should be added:—"And that it will not at any future time allow free importation of bounty-fed sugar."

The resolution with the addition was adopted, and it was agreed that the President of the Board of Agriculture and Fisheries, and the President of the Local Government Board should be requested to receive a deputation on the subject.

Cuba.

A correspondent in Cuba referring to the crop just cut says that while the yield in weight is less, the sugar content is at least 10% higher. As to the political situation, it naturally causes anxiety; and it is feared that whatever the Americans decide to do, there is bound to be more or less trouble and uprisings with the usual burning of fields. One thing seems absolutely certain to our correspondent: the Cubans are quite incompetent to govern themselves and must be taken care of by somebody.

Attention is drawn to the fact that owing to the increasing number of our advertising pages, an *Index of Advertisers* has been found desirable. This now appears regularly on page x., and we have no doubt it will supply a want that has been felt for some time.

THE RENEWAL OF THE BRUSSELS CONVENTION.

Under this heading we read in the *Sucrerie Belge* of February 1st, a translation of the principal passages of a speech delivered by Dr. Bartens, Editor of the *Deutsche Zuckerindustrie*, at a meeting of the Eastern section of the German sugar industry held at Bromberg on the 15th December, 1906.

The speaker lays stress on the importance of consulting the industry before the German Government enters into any negotiations for the renewal of the Convention, even without the participation of England. But, further, he urges the necessity for considering numerous questions with regard to the terms of the Convention before the re-commencement of negotiations, and for that purpose the general assembly of the Society of German Sugar Manufacturers is to be held this year in Berlin.

After touching on several minor points Dr. Bartens comes to his main grievance, and as he has unfortunately been misinformed as to the facts it is desirable that the error should be pointed out. He affirms that, with regard to various Countries accused of giving bounties, the Delegate of Great Britain was at first the most emphatic among the Delegates in condemning them, but that at a later period the British Delegate took up an entirely different attitude. Now, as we happen in this country to enjoy the opportunity every six months of reading the Official Report of the British Delegate we can give this erroneous assertion a prompt contradiction. The British Delegate has from the first been consistently firm in maintaining his opinion that a country which retains a surtax, that is, an excess of import duty over excise duty, exceeding the limit prescribed by the Convention, cannot be condemned as giving a bounty unless it can be shown that the surtax has actually resulted in the creation of a bounty. He acknowledged at once that in certain countries, Russia and the Argentine Republic for instance, the surtax has created a bounty, and he therefore agreed that a countervailing duty should be formulated with regard to those countries. But in the case of many other countries he claimed that no duty should be fixed until clear proof had been given that a bounty had arisen from the surtax. Eventually he carried his point and a long list of provisional countervailing duties was struck out. His argument was clear and unanswerable, as is proved by the result. In the case of Brazil, very great pains was taken to ascertain the facts and in the end there seemed to be no doubt in the minds of any of the Delegates that the conclusion arrived at was fully justified.

But we quite agree with Dr. Bartens that "the permanent Commission must vigorously maintain the principle that surtaxes exceeding six francs *can give rise to bounties*," just as we also agree

with the British Delegate that any bounty so arising must be shown to exist.

We would also refer Dr. Bartens to Sir Henry Bergne's clear statement of the reasons why the preference enjoyed by Cuba in the markets of the United States cannot be regarded as coming within the terms of the Convention, and could not under any circumstances, for diplomatic reasons in connexion with our commercial treaties, be treated as a bounty. It would be impossible, therefore, to agree to Dr. Bartens' suggestion that, in case the Convention were prolonged, an article should be added which would regard as bounties such advantages as those enjoyed by Cuba in the United States.

HOME-GROWN SUGAR.

The volume of the *International Sugar Journal* for 1906 contains several articles on the highly interesting and important question of producing some of our consumption of 1,600,000 tons of sugar in our own country, with our own labour, our own machinery, and from our own land. It seems preposterous that the European country which has the largest sugar consumption should be the only one that produces no sugar, and yet the matter never seems to have struck the mind of the British Statesman in that light. He goes on wrangling from year to year about matters of no practical interest while plain and urgent simple questions such as this never occur to him.

Among the various information on the subject put before our readers we extracted from the *East Anglian Times* and reproduced at page 57 of Vol. VIII. (1906) what struck us as a remarkably able and accurate contribution towards the education of the British public on this matter. The author, Mr. F. W. Mason of Felixstowe, has evidently made a careful study of the sugar industry on the Continent and obtained reliable information from practical men on the spot, seeing at the same time with his own eyes the agricultural and industrial processes connected with this most important industry.

We now have a further contribution—a still more valuable one—from Mr. Mason towards the elucidation of the question "Shall we produce our own sugar?" The East Suffolk Chamber of Agriculture has issued a pamphlet on the growth and cultivation of sugar beet, giving the results of experiments in 1906, together with a most instructive Report by Mr. Mason. The Chairman, Mr. E. G. Pretyman, formerly M.P. for the Woodbridge division of Suffolk and member of Mr. Balfour's Government, writes a brief introduction in which he rightly says that Mr. Mason's "brief and modest report epitomises the knowledge he has gained from constant intercourse with practical agriculturists and chemists who work the great sugar industry on the Continent of Europe."

Mr. Mason says in his Report:—

> "The position now appears to be,—Can roots be grown at a profit to farmers at a price of about 18s. per ton delivered at a factory? Would sufficient land be promised for cultivation to keep a factory supplied which would require 21,600 tons of beet from an acreage of 1,800 acres per season, for, say ten years? Would a manufacturer, if he had those quantities guaranteed, feel justified in establishing a factory?"

He proceeds to answer those three questions. To the first and second his reply is unfavourable. He believes that "the inducement is not sufficient for them to alter the economy of their farms." He thinks that "under present conditions they are doing fairly well" and would not be prepared to guarantee a sufficient acreage. His reply to the third is "Yes, if he can get assistance from the Government by remission of the Excise duty."

As the fate of the sugar duty will be decided before our next number is published we will defer our further consideration of Mr. Mason's valuable and weighty Report till then.

Lord Denbigh has also been making most valuable contributions towards the right understanding of this subject. He addressed the Central Chamber of Agriculture at a Council meeting on the 6th November, 1906, and has further stated his views in an extremely lucid and concise paper contributed to the Official Organ of the Central Chamber of Agriculture and since reprinted for circulation. We shall, in returning to this question next month, examine this valuable paper carefully, in conjunction with the views expounded by Mr. Mason.

THE "DRUELLE-SAY" PROCESS FOR THE TREATMENT OF MOLASSES.

By L. Pellet.

Although the "Druelle-Say" patent is already some years old and has been tried with success in a number of French usines, we think further information regarding same may be of interest. The process is based on the well-known fact that first molasses, especially when not much diluted by excessive washing of the sugar in the machines, eventually contains a considerable quantity of fine grain. This is due to the diminished solubility of the contained sugar after cooling and is proportional to the degree of supersaturation.

In ordinary work it is customary to re-dissolve this fine grain by diluting the molasses to 28-30° Beaumé before re-boiling. The "Druelle-Say" process has for its object the separation of this fine grain by passing the molasses through a filterpress; the result being a cake of granulated sugar and filtered molasses.

In order to see the advantage of this process, let us suppose we have to treat a molasses with an apparent purity of 76·0, containing a quantity of fine grain. After filtration, a certain quantity of sugar is removed and, consequently, the purity of the filtered molasses is lowered. Under the worst possible conditions a fall of at least 6° of purity may be expected when the process is properly carried out. In the above case, the purity of the filtered molasses will be 70·0, and on re-boiling these a "second" masse-cuite is obtained of such low purity that, when cured, the resulting (second) molasses will show a purity of less than 60·0, and therefore not require to be re-boiled to third masse-cuite.

The sugar, separated in the form of cake, is dissolved in the hot juice after second carbonatation and recovered in the first masse-cuite, thereby increasing the yield of first jet sugar, reducing that of the second, and entirely suppressing the third.

It will be seen that the object in view is to separate as much sugar as possible in the form of cake, so as to obtain the maximum reduction in the purity of the filtered molasses. The details of the operation are as follows:—The molasses, which escape from the centrifugals at varying temperatures, are cooled to as low a temperature as possible, so as to reduce the solubility of the sugar and thus force it to crystallize out, but we intend to describe this operation more fully in a later paper. After this treatment, the molasses are passed through a filter press, or the ordinary scum presses can be employed in the absence of special apparatus. Thus, at one usine where this process is in operation, they use Dehne filter-presses with 50 frames (90 by 90 cm.), and a total filtering surface of about 81 square meters.

From each of these presses about 2000 kg. of cake are obtained, the quantity of molasses treated per press depending on the amount of "fine grain" present. The frames are covered with cloths of jute and of cotton, which should last for at least three weeks under continuous working.

A filter-press having 100 square meters of surface will amply suffice for a 750 tons installation; nevertheless, to ensure continuous work, it is better to have two filters of a lesser capacity. It is also advisable to employ shallow frames to ensure well-formed cakes, which can be dried easily under air-pressure.

When the press is full the supply of molasses is shut off and air admitted under pressure, which displaces the interstitial molasses. The resultant cakes are allowed to drop into a helical conveyor underneath the press, by means of which they are conveyed to the hot filtered second carbonatation juice. The resulting solution, which possesses a purity almost equal to the first syrup, is finally returned to the pan or to the evaporators.

After the filter-press has been emptied and re-adjusted, a small quantity of second carbonatation juice is introduced in order to clean the cloths, and subsequently displaced by admitting compressed air. The filtered syrup thus obtained passes to a tank whence it is drawn into the pan as required.

The quantity of cake obtained varies according to the fall in purity of the molasses, and is deduced by means of a very simple calculation. Given a molasses of the following composition:—Brix, 86°; purity before filtration, 76°; purity after filtration, 70°. If we suppose the cake to give 76° Brix and 94° of purity, the quantity of sugar removed per 100 grammes of original molasses will be:—

$$\frac{100 \times 86\ (76 - 70)}{96\ (94 - 70)} = 22{\cdot}4 \text{ gr.}$$

The density of the molasses is a very important point in the process, but one which is nearly always neglected in ordinary work. If, by a too liberal application of water or steam in the centrifugals, the Brix of the molasses falls below 82, this material will contain an excess of water, and the subsequent cooling does not result in supersaturation, so that little, if any, sugar is obtained on filtering, and the purity of the filtered molasses is only lowered a degree or two. But, it must be noted, this contretemps only arises when the molasses show an abnormal Brix.

By this very simple process we can dispense entirely with the third jet masse-cuites, considerably reduce the seconds, and increase the quantity of firsts.

Apart from the simplicity of the operations, the fact that the volume of masse-cuite is considerably reduced has been proved in practice, no less than by calculation, whence results a corresponding saving in fuel, to say nothing of the improvement in the quality of the masse-cuites.

As to the cost of installation, this is only a small item, as there are generally some spare presses kept in reserve.

Naturally the process is just as applicable to cane molasses, and we may mention that it has given entire satisfaction in Egypt, having been introduced in a 2000 ton factory.—(*Bulletin des Chimistes.*)

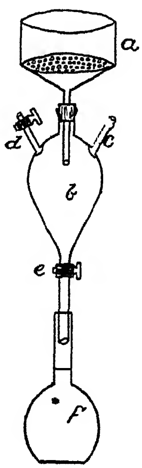
Queensland is anticipating a shortage of labour now that the Kanakas have been sent away, and Mr. Deakin, the Commonwealth Prime Minister, realizes this so clearly that he has given permission for the importation of outside white labour. Accordingly attempts are being made to get 1,000 Italians from Europe, and a representative of an Australian sugar company has been sent over to try and secure them.

A PROCESS TO ELIMINATE THE ERROR DUE TO THE VOLUME OF THE LEAD PRECIPITATE.

By Noel Deerr.

In the following note I assume that the lead precipitate exercises an influence upon the polarization.

I have used the apparatus shewn in the accompanying diagram as a means of eliminating this error. The apparatus consists of a Buchner funnel *a*, the stem of which is inserted through a rubber stopper into the neck of a Diamond filter flask *b*. The filter flask is provided with two tubulures *c* and *d*. The tubulure *c* is connected with a filter pump, and that at *d*, which is provided with a cock, serves to break the vacuum, when it is desired to discharge the contents of the flask through the cock *e* into the graduated flask *f*.



I have used the apparatus as follow:—Two hardened filter papers are placed over the perforated disc in *a*, moistened with water, and connection made to the pump. The papers are then drawn firmly down on the perforated plate. The solution under analysis, to which the requisite quantity of lead acetate has been added, is then introduced into the Buchner funnel and connection made to the pump. When about 20 cc. of filtrate have passed through, the connection to the pump is closed, the air cock at *d* is opened and the contents of the flask *b* discharged into the graduated flask *f*. This process is repeated until the whole of the filtrate has passed through. The precipitate remaining in *a* is then washed with successive quantities of water, ten cc. at a time, the washings being discharged into *f* without

mixing until all sugar has been brought into *f*. The contents of *f* are then made up to definite volume and are ready for polarimetric assay.

The object of discharging the contents of *b* into *f* in small quantities is to avoid the necessity of washing a large interior surface in the filter flask. I find that in this way 150 cc. of a juice can be treated so that the total volume of filtrate and washings is 300 cc. The filtrate after completion to exact volume is polarized in the 40 cm. tube.

The first runnings through the filter paper are generally turbid; these may be collected separately and returned to the Buchner funnel. In general, however, I find it more expeditious not to do this, but to filter the collected filtrate after making up to exact volume in the usual way. The very small volume of material that is present in the filtrate is quite beyond appreciable limits.

The whole time taken for a determination by this method varies from 60 to 90 minutes; it is not then suited for those control analyses in a sugar factory, which demand rapidity rather than great accuracy, but it might, perhaps, be recommended for such determinations as the daily analysis of the mixed juices upon which so great a part of the chemical control of a factory pivots.

INTERNATIONAL SUGAR COMMISSION.

Autumn Session, 1906.

The official Report of the proceedings of the Brussels Commission at their session last autumn has just been issued as a Parliamentary paper.

For the first time Switzerland was represented by a delegate, who however was without the right to vote. His country's contribution to the expenses was fixed at 1000 frs. It was at the same time announced that certain Swiss bounties to which exception had been taken were now suppressed.

M. de Smet, the Director of the Permanent Bureau, read the Report which had been prepared on the present position of the sugar industry in Brazil.

After some discussion the Commission accepted the conclusion of the Permanent Bureau, to the effect that no changes had been made in the legislation of Brazil of a nature to modify the decision previously taken in regard to that country. That decision, it will be recollected, was that the countervailing duties originally fixed as applicable to Brazilian sugars need not be maintained.

The next subject of discussion was a contract between the Mexican Government and a group of capitalists with the object of promoting the production of beet sugar in Mexico. It was recognized that this

contract could not become effective for some years, and that, consequently it was only necessary for the Permanent Bureau to keep itself completely informed upon the subject.

The Permanent Bureau had prepared a report concerning sugar production in Costa Rica, tending to show that there was no exportation of sugar from that country. In these circumstances, M. de Smet, the Director, suggested that the countervailing duties previously fixed for Costa Rican sugars need not be maintained. The British Delegate supported this view, but the Commission, after some discussion did not consider the question sufficiently elucidated to warrant the cancellation of the previous decision. The British Delegate did not think it necessary to contest the point, since Great Britain receives no sugar from Costa Rica, and the issue of a prohibition order in regard to Costa Rican sugar has not been found necessary in the United Kingdom. It was eventually agreed that the question should be reconsidered at the next session of the Commission, by which time the Permanent Bureau would be in possession of more complete information.

The next question was the revision of the countervailing duties previously fixed for Roumanian sugar.

It appeared that in consequence of recent changes in Roumanian law the figures previously fixed ought to be reduced to:—

	Per 100 kilog.
Refined sugars	20·00 fr.
Raw sugars..	15·25 ,,

This implies a reduction by 2·50 fr. in each case in the rate of countervailing duty, and the Commission decided accordingly.

Some discussion then took place in regard to a bounty on sugar production granted in Uruguay, but the Permanent Bureau having reported that, according to the latest information, there was in reality no sugar production in that country, the matter was allowed to drop on the understanding that the Permanent Bureau should collect further information upon the subject.

M. Földvary, the Hungarian Delegate, then suggested that it would be useful if the Permanent Bureau would undertake to prepare a complete statement of the world's sugar production, with the object of showing the augmentation or diminution of production in the various countries. He proposed that the statement should commence five years before the Convention came into force. M. Delatour, the French Delegate, suggested that the statement should embrace also, so far as possible, the figures of consumption and exportation.

The President promised that the Permanent Bureau would do its best to produce such a statement.

Spain has now 55 beet sugar factories, but all of them are said to be regulated, if not virtually operated, by the Spanish Sugar Trust.

THE PAST YEAR IN DEMERARA.

The year 1906 can not be considered one of more than moderate prosperity to the colony.

The first three months of the year were characterized by a prolonged and severe drought, broken towards the end of March by rains of exceptional severity; afterwards the weather remained fairly favourable to the cane cultivation and a wet August further helped on the end of the year crop. The mid-year crop was to a large extent ruined by the drought experienced in the first quarter of the year. At the commencement of the end of the year grinding in September very favourable estimates had been formed as to the prospective yield of the balance of the crop, but though to all appearance the cane was present in more than average bulk, the sugar content was very low and the juice amongst the most impure that has been observed in recent years; at the beginning of the crop purities under 70 were not uncommon, and possibly, the wet August causing a second growth in the cane may be responsible for these abnormal figures; at the same time the glucose content of the cane was very high, in some instances amounting to as much as 2%.

Rind and root fungus were sporadically present, but no such outbreak as occurred in Essequebo in 1905 was reported.

The cultivation of seedling varieties continues to be extended to the exclusion of the *Bourbon*; it is to be hoped, however, that this variety will not be completely abandoned, as possibly when lands have been rotated with other varieties the *Bourbon* may be found to grow in them with renewed vigour.

D 625 is the seedling that continues in greatest favour, its only rivals in the estimation of most planters being *D 109* and *D 145*. The Barbados seedling *B 208* continues to be extensively grown on one estate, but Mr. J. B. Harrison has recently remarked that perhaps the cane known as *B 208* on this estate is different from that generally accepted as this variety. The *White Transparent* continues in cultivation on a large scale on one estate, and the cultivation of the seedlings *D 74*, *D 117*, *D 78*, *B 147* and *B 109* is decreasing.

This year it has been noticed that the cane *D 109* when in ratoons has a distinct atavistic tendency, and much of the older ratoons of this variety differed but little from wild cane.

The cultivation of the *Striped Tanna* cane is being experimentally conducted on several estates.

The price of sugar in the local market has varied from \$1·70 to \$2·27 per 100 lbs., and at the close of the year quotations varied from \$1·80 to \$1·82. The price of rum in the English market has, however, been remunerative.

The exports of sugar were 119,879 tons, while probably not less than 5,000 tons was used for local consumption.

About 2,541,000 gallons of rum and 13,965 tons of molasses—cattle food—were exported. The total acreage under cane cultivation was 74,214 acres, of which perhaps 4,000 acres would be turned over; taking the acreage actually cut as 70,000 and the total production of sugar as 124,000 tons, the average return per acre was 1·77 tons. Of the exports of this sugar 62,796 tons went to Canada, 40,454 to the United States, the United Kingdom accounting for nearly all the balance. The great bulk of the sugar made was refining crystals, very few estates making "Demerara" crystals.

For the first time rice, of which 170 tons was exported, figures largely in the exports; many estates have given facilities for rice planting with the object of attracting a reliable resident labouring population, and likewise beyond the limits of the estates rice is largely grown; the rice harvest coincides with the sugar harvest and for a time estates had great difficulty in obtaining sufficient labour; it is the industrious East Indian immigrant who has become the sugar estate's chief competitor for the day-labour of the thriftless negro; notwithstanding the scarcity of labour there has not been wanting an irresponsible portion of the community advocating the cessation of East Indian immigration.

The usual amount of new machinery has been imported; two estates have been converted from single to double crushing and through an amalgamation another single-crushing factory disappears. Of the 42 factories now working, the great majority have fairly efficient double crushing plants; a very few factories employ treble crushing and two or three single crushing mills remain. The twelve-roller mill has not yet reached the colony. In comparing the crushing plants in this colony with those in other districts, it must be remembered that the canes grown in Demerara are much less sweet than those in other cane growing districts, so that there does not exist the same incentive to exhaust with water the dry crushed megass.

Another cane lifter and discharger has been installed during the past year.

Mechanical steam cultivation was tried on the properties of the Ewings in this colony a generation ago, but little has been done in this direction during recent years. During the coming year, however, steam cultivation will again be tried on the largest estate in the colony.

The annual deputations of the "sugar users" to the Chancellor of the Exchequer, praying for the remission of the sugar tax, have lately gone their round. As in former years the reply has been a non-committal one, but the usual expressions of sympathy have been offered.

USE OF SODIUM HYDROSULPHITE IN THE PREPARATION OF CANE PRODUCTS FOR POLARIMETRIC ASSAY.

By Noel Deerr.

In the *Int: Sug: Jour:* Vol. VIII., p. 388, I indicated a method whereby cane products could be prepared for polarimetric assay by the precipitation of alumina within the solution. In the process as I then described it, the alumina was precipitated by the interaction of sodium aluminate and aluminium sulphate, the latter being added to the solution in very slight excess.

The clarification can, of course, be also effected by the interaction of sodium aluminate and an acid, or by that of a soluble alum and an alkali.

In my original note on the process, I mentioned that the best results were obtained with products that were naturally light coloured, and with reference to refuse molasses I stated that the highest reading that could be satisfactorily observed was one of 7 Ventzke degrees.

Recently a new product has appeared on the market under the name of "Hydrosulphite B.A.S.F. Powder Z.": This body, which is the sodium salt of hydro-(or hypo-) sulphurous acid is now largely used in the dye industry, and has also been applied in sugar manufacture on a large scale.

This body was used by Pellet* in combination with neutral acetate of lead to effect the decoloration of molasses, but with unsatisfactory results. "Donc il n'y a aucune utilité à employer l'hydro pour la décoloration des mélasses, puis qui' il n'y a pas plus de décoloration qu'avec l'acétate neutre seul, même à chaud et encore là on diminue un peu la polarisation."

In conjunction with precipitation of alumina within the material undergoing analysis I find that hydrosulphite has a very remarkable effect, and that a decoloration very little inferior to that obtained with the use of basic lead acetate results.

With juices, sugars and first products generally, the decoloration obtained is appreciably the same as when using basic acetate of lead; with the darkest refuse molasses concentrations of molasses may be used, such that a reading of 20 Ventzke degrees is obtained. With a solution of molasses of this concentration, the filtrate, obtained as below, is of a golden yellow colour; the colour is such that solutions offer comparatively little resistance to the passage of light, and sharp readings can be obtained in the polariscope when, judging from the depth of colour alone, it might be supposed that an accurate observation would be impossible.

* Bull. de l' Assoc. des Chim. de Sucr. et de Dist. xxiii. 10., p. 1131.

During the past few months, I have made several hundred analyses by this method which I now use as under.

To 50 cc. of a juice, or solution of molasses or sugar contained in a 100 cc. flask, a certain quantity of a solution of sodium aluminate is added, followed by the addition of very little more than an equivalent quantity of a saturated solution of aluminium sulphate. About ·25 grms. of dry hydrosulphite of sodium is then placed in the flask, the contents of which are then completed to 100 cc., shaken violently and filtered.

When using a saturated cold solution of aluminium sulphate and a solution of sodium aluminate of equivalent strength, I find that the minimum quantities of each solution required are:—

Per 100 cc. of juice, 4 cc.

Per 26 grams of 96 test crystals, 1 cc.

Per 26 grams of molasses, 10 cc.

In common with the lead clarification process the volume of the precipitate is a source of error; the quantity of alumina precipitated within the solution is the predominant factor determining the volume of the precipitate; when analysing materials of approximately the same composition, I am of opinion that it is only necessary to determine once and for all the volume of the precipitate formed per unit quantity of alumina precipitated, and to apply this correction to all subsequent analyses. I have been unable to obtain any evidence that the precipitate entrains sugar.

The following comparative analyses using basic lead acetate, neutral lead acetate and alumina in combination with hydrosulphite were made:—

1. 100 cc. of juice were clarified with neutral acetate of lead, filtered over reduced pressure in a Buchner funnel, the precipitate washed until free of sugar, and the filtrate and washings made up to 300 cc. The readings were observed in the 60 cm. tube.

100 cc. of the same juice were treated similarly, the clarification being made with alumina and hydrosulphite.

The following readings were observed:—

Neutral Lead.		Alumina and Hydrosulphite.
58·57	....	58·58
54·82	.....	54·79
52·92	....	52·89
56·12	....	56·14

2. 100 cc. of juice were clarified with 3 cc. of basic acetate of lead of density 1·27, made up to 300 cc., filtered, and the filtrate polarized.

The same juice was clarified with alumina and hydrosulphite.

Correction for the volume of the precipitate in this case was made by what is known as Sachs' method, except that the precipitate was washed free from sugar on a Buchner funnel over reduced pressure.

The following readings corrected for volume of precipitate were obtained in the 60 cm. tube:—

Basic Lead.		Alumina and Hydrosulphite.
51·74	......	51·54
58·58	....	58·44
52·72	....	52·44
60·79	......	60·51

3. A solution of a refuse molasses was treated exactly as in the series next above; the lead acetate was not added in excess, the addition of lead acetate to the filtrate in all instances forming a further precipitation:—

Basic Lead.		Alumina and Hydrosulphite.
17·14	....	15·59
16·69	....	15·09
11·25	....	12·32

In all the above experiments the reading entered is the mean of ten observations.

As a means of avoiding certain of the objections to the use of lead salts in sugar assay, the experience gained over several hundred determinations made during the last crop just finished in Demerara justifies me, I think, in calling the attention of sugar analysts generally to the use of alumina and hydrosulphite in combination as a cane sugar clarificant.

THE INFLUENCE OF THE LEAD PRECIPITATE IN CANE AND BEET SUGAR ANALYSIS.

By H. and L. Pellet and Ch. Fribourg.

Mr. Noël Deerr published in the January issue of the *International Sugar Journal* (p. 13) a note concerning the influence of lead precipitate in cane sugar analysis, and gave there the results of a number of experiments he had made which led him to the following conclusions:—

1. Solutions of cane products when made up to different volumes in the presence of the lead precipitate tend to give nearly identical polarizations, when the readings are made at different concentrations.

2. This effect is due to the compensating effect of the volume occupied by the lead precipitate and the increase in specific rotation with dilution.

3. The lead precipitate has an effect on the polarization, and neglect of this tends to give a plus error to observations made under the conventional method of analysis.

We should like to remark that Mr. Deerr has evidently not repeated our experiments under the conditions we have previously indicated, for we are convinced that he would then have obtained different results. In the first place, such experiments should be carried out under ordinary working conditions, but this was not done in the present case. Mr. Deerr took two solutions, one of cane juice, the other of molasses. The former polarized 25° to 27·8° in a 10 cm. tube, while the latter was diluted to 19·5° Brix.

To each 100 cc. of juice and of molasses solution the same quantity of subacetate of lead was added, viz., 10 cc. Now, we consider this amount excessive in the case of the juice, and deficient in that of the molasses.

We would suggest that Mr. Deerr should take one of these solutions, that of molasses, dilute it to, say, 20° Brix, and then determine the amount of subacetate required to completely precipitate the impurities present in solution, but avoiding any great excess of the re-agent. This may need several tests, but with a little practice one or two attempts will enable him to gauge the effect of a known quantity of re-agent on the solution under treatment; it is then only necessary to use exactly this proportion in the course of his experiments, and to employ distilled water only for dilution. He should then prepare a solution of pure sugar, having the same polarization, to serve as a control, this being similarly diluted and polarized in the same tube, having previously ascertained that the instruments are all accurately graduated. This completed, Mr. Deerr should take 25 cc. of the above solution of molasses, add the necessary volume of subacetate of lead, mix thoroughly, and filter.

Wash the precipitate with tepid water until the original filtrate and washing amount to nearly 200 cc. Cool, dilute to 200 cc. and ascertain the temperature. All further experiments should be carried out on solutions brought to this temperature. After the first 200 cc. of filtrate have been polarized, continue washing the precipitate until a second 200 cc. are obtained which is also polarized. The sum of the two polarizations gives the total amount of sugar in 25 cc. of molasses solution or rather the polarization corresponding thereto.

To another 25 cc. of the molasses-solution add the same amount of subacetate of lead, and complete the volume to 200 cc., mix, filter, and polarize in the same tube and under conditions of temperature similar to those in the first experiment.

The two results should agree within 0·1 of a degree of the saccharimeter; this having been proved not only by our own experiments, but by those of M. Fribourg. It follows that the lead precipitate present in the second experiment has nowise affected the polarization, the error due to the volume of the precipitate being

neutralized by the absorption of a portion of the sugar, which is retained in the precipitate.

In the first experiment this "absorbed sugar" was removed from the lead precipitate by washing in exactly the same way as one washes a precipitate of alumina free from potash salts.

Hence it is evident that the lead precipitate has no influence and, under the conditions stated, any influence due to dilution remained the same in both cases.

We are ourselves at present engaged in new experiments to ascertain not only the influence of dilution on the polarization of cane sugar products, but likewise the influence of the alkalinity due to the presence of the subacetate of lead, and to the re-action produced; also the effect of neutralizing this alkalinity by means of acetic acid.

Meanwhile we assert that we have tested solutions of cane molasses of varying degrees of dilution and obtained similar results; having studied the question not only as regards the influence of dilution on the polarization, but also on the apparent density (Brix), so as to show that the dilution did not affect the apparent purity.

For if we admit the theory of Mr. Saillard and others that the dilution influences the apparent Brix; and, also, the theory of Mr. Deerr regarding the influence of dilution on the polarization of cane products, we are forced to the conclusion that all analyses of juice and sugar solutions carried out under different degrees of concentration are entirely inaccurate in respect to apparent purity. We maintain on the contrary that numerous experiments have proved that if the Brix instruments be carefully verified (they are always more or less faulty whatever be the price paid for them) and a suitable table of corrections drawn up, the apparent purity remains constant, whatever be the dilution. This was pointed out quite recently by M. Vivien and we have found the same to be the case when dealing with beet sugar products.

Mr. Deerr states that Messrs. Sachs and Barbari conclude that although the lead precipitate itself has no practical influence, the acetate of potassium formed reduces the polarization. We have, however, shown this to be untrue and if Mr. Deerr will examine the matter, we trust he will confirm our results.

Finally, if Mr. Deerr's new theory be sound, it is at any rate only applicable to cane sugar products and cannot be accepted in reference to beet sugar. For the beet products contain only a trace of matters susceptible to the influence of subacetate of lead, so that it would be necessary to admit that the sugar itself when polarized in solutions of varying dilution gives different results. It is

for this reason that we have requested Mr. Deerr to extend his experiments to solutions of pure sugar. We ask him to state the actual composition of his molasses, and the normal weight of the saccharimeter he employs. We shall do the same when we publish the results of our new experiments carried on during the present campaign in Egypt.

Note by Mr. H. Pellet.—It must be admitted that the first conclusion arrived at by Mr. Deerr is entirely in agreement with the conclusions of many experimenters. So far, so good. Time will show whether the new theory is to be accepted, but we think this is improbable in view of our own experiments, especially those carried out on beet products which differ greatly from the products of the cane. Our own conclusions, which were arrived at 23 years ago, fully confirm those of M. Commerson dating back 30 years, and of M. Raffy, which were published 24 years ago. Again, Messrs. Gillot and Grosjean, chemists to the central factory at Wanze (Belgium), have in the course of a very detailed work (of which a summary appeared in the *Bulletin*) completely confirmed our conclusions as follows:—"In the case of beet products, the lead precipitate has no influence whatever, and if it had, the effect would be additive rather than subtractive."

The third conclusion of Mr. Deerr is not very clear; it points to a *plus* error arising from the lead precipitate in the case of observations made under the conventional methods of analysis. This appears to be opposed to Conclusion No. 1. We would remind him that all cane sugar products, juices, syrups, masse-cuites, molasses, etc., can only be analysed by Clerget's inversion if accurate results are desired, and that this always gives a higher figure for sucrose than does direct polarization, even in the case of raw sugars. This increase in polarization is always much greater than could be theoretically attributed to the influence of the lead precipitate, as is proved by experience. Consequently, we tell the sugar merchants that if, on their side, a reduction has to be made for the influence of the lead precipitate (which influence is nil) they have only to insist on an analysis by Clerget's method in order to secure a high polarization, free from any such reduction.

We have proved this in the case of Egyptian sugars and of American products kindly sent to us by Dr. Horne.

HAWAIIAN WASTE MOLASSES.*

By S. S. Peck.

For every ton of sugar manufactured in Hawaii there are produced from 15 to 23 gallons of molasses of a sucrose-content averaging 35%. It is, therefore, of the greatest importance to be able to decide correctly whether or not the attenuation of the molasses is complete, within economic limits, and likewise to keep the amount of it down to a minimum.

The loss of crystallizing power of molasses has been variously ascribed to ash, glucose, gums, and combinations of two or all three of these. A brief resumé of different opinions collected from many sources is given herewith.

> "Ash is supposed to be the most deleterious element, as it "destroys or prevents the crystallization of three to five times its "weight of sugar."
>
> "Salts act either by their invertive action or by a specific "effect, differing for each salt, whereby they retain the sugar in "solution without altering its chemical composition,"

and

> "The solubility of sugar is increased by the large presence of "bodies other than sugars, notably the organic salts of potash, "while the salts of soda and inorganic salts of potash increase "the solubility of the sucrose only slightly; certain salts, as "sulphate of soda, chloride of calcium, and sulphate of magnesia "even cause crystallization of a considerable portion of sugar."

Marschall, Geerligs, and other investigators have likewise studied the melassigenic actions of various salts liable to be found in the juices of the cane and beet, or introduced during the process of manufacture. As will be seen from the analyses of the ashes of Hawaiian molasses given later, their composition varies so extremely that no precise conclusion can be drawn as to the effect of each component part of the ash on the sugar content.

From those who ascribe the non-crystallization of the sucrose to the action of invert sugar wholly or in part, we quote :—

> "Invert sugar as an agent preventative of crystallization is "second only to the salt of the ash."
>
> "It is well understood that . . . . . each part of invert sugar "or glucose prevents an equal amount of sucrose from crystal- "lizing."
>
> "On the hypothesis that glucose is the only impurity in our "cane juices which materially affects crystallization."

* Condensed from Bulletin No. 18 of the Hawaiian Sugar Planters' Association.

Regarding the role played by the gums, we read that:—

> "One pound of gum prevents two pounds of sugar from "crystallizing."
>
> "As the result of superheat clarification and the freeness of "the juices from gums, it was found that the molasses were also "freer of the so-called gums, and it was found possible to gain "sugar in the pan out of molasses whose purity did not permit "it the year previous."

Regarding the influence of glucose *per se*, many experiences in Louisiana, where the juices themselves already contain a high percentage of this element, show that even where it is present in large quantities in the molasses, sucrose can still be recovered. The statement found in Tucker that

> "The lowest molasses of commerce from which all sugar has "been crystallized that it is practicable to get, will retain from "25 to 30% cane sugar to about an equal amount of invert sugar"

is scarcely in accord with the following working experiences:—

> "A molasses containing 33·2% sucrose and 33·74% glucose gave "a masse-cuite which grained excellently in the wagons, "'swinging' out well in the centrifugals, and yielded 12·06 "pounds of commercial sugar per ton of cane."

Edson in the *La. Planter* of 1893 states:—

> "I have seen a whole crop of thirds with an average purity of "39·10 and a glucose ratio of 73·19, single polarization, produce "sugar of approximately 80 degrees test, leaving a molasses of "13·95 purity, and a glucose ratio of 253·44. There were in "this crop single lots which gave a molasses with a glucose ratio "of 297·0. As the molasses gave this result, crystallization "must have taken place in a material which was just below "this ratio."

Another, writing about the same time, is forced to the conclusion that

> "But little reliance can be put in the method of estimating "the available sugar by deducting 1½ times the glucose from "the sucrose."

In an exhaustive study of the final molasses in the factories of Java, extending over many years, Mr. Prinsen Geerligs has concluded that it is by the ratio existing between the invert sugar and salts that the extent of the solubility of the sucrose in the water of the molasses is established; a low solubility coinciding with a high quotient between the glucose and the ash, within, of course, certain limits. In support of this hypothesis he presents the analysis of a great number of final molasses, in which this correspondence of sucrose per hundred water, and glucose-ash ratio, is fairly constant.

With the object of ascertaining whether or not this measure of the complete attenuation of molasses could be applied to the products of Hawaiian mills, a number of them were analysed during the past two seasons, and the results are presented herewith. In attempting a comparison of these, several facts must be borne in mind. It is true that as far as the methods of clarification of the juices are concerned, they are fairly comparable, all of them being defecated with lime alone, the molasses from the mills employing sulphurous-oxide not being represented. But they originate in juices of varying purities, are clarified with lime, some to neutrality, others to alkalinity, and not a few are allowed to remain slightly acid; some are clarified in open clarifiers, others by the Deming superheater; some are boiled according to the Java process, and producing but two grades of sugars, others are boiled to produce four grades, the lower being remelted and remade into first sugars, or drawn directly into the pan, being partially remelted in the thick syrup which is drawn in on them, and acting as a nucleus for the new grain. In some mills the low grades are handled in crystallizers; with others they are boiled to string proof, placed in wagons, in small tanks of various dimensions and constructions and material, or in large wooden tanks, where they are allowed to remain, sometimes a few weeks, and, again, several months. With some, the "ash" represents the original ash of the juice and the lime used in clarification, less the precipitated phosphates, &c., removed in the scums, the depositions, as scale, in the effets, and the settlings in the blow-up tanks; with others, Solvay soda is added to correct the acidity of the molasses and its frothing when boiled, thus affecting the soda percentage in the ash, slightly it is true, but vitiating any attempt at accurate comparison of the action of the inorganic constituents. The composition of the ash is further complicated by the environment of the cane itself, as will be pointed out later. Again, these molasses are accepted as the final products of the mills which sent them. In some instances false grain could be discerned, thus raising the "sucrose per 100 water" above what is actually held in solution in the water. Lastly, it is not improbable that what represents an exhausted molasses in one mill might in another, with different pan construction, or perhaps simply with a larger capacity for low grade boilings, give a further and profitable crop of crystals.

In Table I. the molasses are arranged according to the sucrose contained per 100 water. In addition to the necessary data are given the true and apparent purity of each molasses, these being the usual methods by which the sugar-boiler adjudges them, and as showing that none of these molasses differ greatly in their composition from the average of the Hawaiian Islands.

TABLE I.

No.	Water.	Sucrose.	Glucose.	Ash.	Sucrose per 100 Water.	Glucose: Ash.	Apparent Purity.	Real Purity.
19	16·20	36·57	7·55	14·93	225·7	·51	35·99	43·73
24	16·45	36·63	20·83	11·28	222·6	1·84	32·94	43·84
13	17·43	38·29	18·00	13·43	219·7	1·34	33·85	46·37
11	18·34	40·04	15·01	11·36	218·3	1·32	..	49·03
1043	18·39	39·00	12·64	10·70	212·1	1·19	44·77	47·40
8	18·20	37·45	17·31	11·47	205·8	1·51	38·02	45·78
23	19·35	39·81	6·74	13·57	205·7	·50	42·59	49·36
12	18·20	36·30	13·33	14·52	199·4	·90	34·61	44·37
16	21·75	42·95	6·67	10·59	197·5	·63	46·33	54·89
1102	18·20	36·81	12·37	13·18	192·8	·84	34·90	45·50
18	19·00	36·60	13·97	11·99	192·6	1·17	37·18	45·18
25	17·08	32·71	18·38	13·02	191·5	1·41	28·92	39·45
21	17·75	33·49	18·90	8·95	188·7	2·11	27·65	40·72
15	19·73	36·45	19·61	13·02	184·8	1·50	33·79	45·41
3	18·11	33·20	11·16	11·76	183·3	·95	31·62	40·54
20	19·15	35·00	14·51	10·21	182·8	1·42	33·00	43·04
1044	20·48	37·20	10·00	10·27	181·6	·97	42·44	46·80
9	19·15	34·20	11·36	11·24	178·6	1·01	27·22	42·83
6	20·94	36·95	8·84	13·25	176·4	·67	37·34	46·61
17	22·85	39·64	14·37	12·15	173·5	1·20	40·61	52·67
1036	19·80	34·23	20·08	7·97	173·0	2·52	34·54	..
2	21·31	36·72	8·92	8·32	172·3	1·07	36·86	46·60
14	20·46	35·17	21·18	10·50	172·1	2·08	35·40	44·22
26	19·05	32·77	8·90	10·13	172·0	·88	35·14	40·48
10	20·64	35·15	14·12	13·44	170·3	1·05	35·22	44·29
1121	21·99	36·65	18·62	8·68	166·7	2·15	35·10	47·00
27	23·74	38·44	14·71	9·06	161·9	1·62	40·50	50·40
7	24·94	39·74	12·54	8·21	159·4	1·53	44·28	50·26
1	24·91	39·12	6·04	8·41	157·0	·72	43·07	52·09
22	23·57	36·69	10·00	11·45	155·6	·88	40·59	48·00
4	24·66	35·23	15·82	7·89	142·8	2·00	37·70	48·09
5	24·66	34·58	21·55	8·46	140·2	2·55	39·02	45·90
1130	28·60	34·20	8·23	8·35	119·6	·98	42·50	47·90
1123	26·74	16·34	29·24	7·49	61·0	3·90	7·34	22·26

Sample 1123, with the lowest sucrose per 100 water, does indeed contain glucose and ash in amounts forming the highest ratio; but the question arises in instances like this, does this measure the successful elimination of sucrose, or a destructive inversion of a part of it? The sum of the sucrose and glucose in this sample amounts to 45·58%, or 170·4 parts per 100 water. That of sample 1130 is only 42·43%, or 148·3 per 100 water, with a low glucose-ash ratio of ·98, while sample 1, with a still lower ratio of ·72 contains 45·16%, or 181·3 per 100 water, which is but a little higher than 1123. If we take molasses No. 1 and suppose that inversion is allowed to take place to such an extent that 22% of the sucrose is changed, it would then analyse: sucrose, 17·12%; glucose, 29·7%, containing 68·8 parts sucrose per 100 water, and having a glucose-ash ratio of 3·54. This example is given as illustrating the fact that with our molasses a higher glucose–ash ratio could as readily be a sign of great inversion having taken place, as a standard of its successful exhaustion.

The inapplicability of this standard to our molasses is doubtless largely due to the fact that in many cases the quantity of salts is equal to or greater than that of the glucose; of the 34 samples, only 12 showing a ratio greater than 1·50, and 12 being less than one. Respecting such a condition, Mr. Prinsen Geerligs modifies his theory in the statement:

> "These constituents (*i.e.* salts) increase the solubility of the "sucrose, just as is the case with beet molasses, which likewise "contain a large quantity of salts, but little or no glucose."—
>
> (On Cane Sugar and the Process of its Manufacture in Java.)

However, in spite of the reversal of the proportions of glucose and ash, no great difference exists between the average amounts of sucrose retained in solution. In 12 samples where the mineral matter exceeds the glucose, there are 180·5 parts of sucrose in 100 water; in 21 samples, where the glucose is greater, and excluding 1123, which is an extreme case, the average amount of sucrose held in 100 water is 182·3. Even including 1123, the average is but little lower than with the ash in excess, viz., 176·8 parts sucrose per 100 water.

In the same treatise, the author says that the effects of placing a foot of water over a low masse-cuite is two-fold:

> "The masse-cuite takes up a little water and becomes less "sticky, while a portion of the viscous salts diffuses into the "water, whereby the quotient between the glucose and ash "rises, and accordingly the amount of crystallizing sugar is "increased."

Another way of effecting this second condition, without affecting the viscosity, would be to add glucose to the molasses, and three such experiments were carried out on molasses 1 and 6, both selected on account of their low glucose-ash ratio. A pure invert sugar solution, containing 68% invert-sugar, and ·05% ash, was prepared from white

cane sugar. The two molasses were slightly diluted with hot water in order to dissolve any false grain that might be present, enough normal sodium carbonate solution added to neutralize the acidity, which had been previously determined in separate samples, and a sufficient quantity of glucose* syrup added to considerably modify the ratio of glucose to ash, in number 1 in the proportion of 30 to 100 molasses, and in number 6, 18 to 158, and 15 to 100. These were concentrated under a vacuum of 26 inches, the temperature not being allowed to exceed 160 degrees. A check sample of each molasses was treated exactly in the same manner, with the exception of the addition of the glucose, and concentrated to about the same density. The following table presents the analyses of the resulting concentrates, along with those of the original molasses for comparison:—

TABLE II.

MOLASSES No. 1.

	Original Molasses.	Concentrated Molasses.	Glucose Added.
Total Solids	75·08	82·60	81·7
Sucrose	39·12	42·76	33·45
True Purity..	52·09	52·01	40·94
Glucose	6·04	6·98	21·38
Glucose Ratio..	15·44	16·39	63·91
Ash	8·41	9·36	7·13
Glucose: Ash..	·72	·75	3·00
Sucrose per 100 Water	157·0	240·0	182·8

MOLASSES No. 6.

	Original Molasses.	Concentrated Molasses.	Glucose Added.	Glucose Added.
Total Solids	79·06	81·24	77·23	80·32
Sucrose	36·95	37·69	33·17	35·50
True Purity..	46·61	46·39	42·95	44·20
Glucose	8·84	9·30	14·87	17·25
Glucose Ratio	23·92	24·67	44·83	49·15
Ash	13·25	13·68	11·90	12·00
Gluçose: Ash	·67	·68	1·25	1·44
Sucrose per 100 Water	176·4	200·9	150·3	180·4

* Throughout this bulletin, the term "glucose" is used interchangeably with "invert-sugar," as is the custom in most mills having chemical control.

The resulting concentrates were allowed to stand for three months, but in no instance was there any sign of crystallization. From these experiments we conclude that an increase of the glucose-ash ratio, accomplished in this manner, will not force out any sucrose from its solution.

The application of water to the surface of an obstinate masse-cuite is an expedient frequently employed by Hawaiian sugar boilers. The sole effect of this treatment is to decrease the viscosity of the masse-cuite, allowing freer movement of its molecules, and the consequent aggregation of the sucrose.

For the purpose of studying the probable relation of the impurities other than glucose and ash to the retention of sucrose, twenty-seven of the molasses were subjected to a more thorough analysis with the results shown in Table III.

By "gums," as has been previously explained, is meant all the impurities, other than ash, precipitated by subacetate of lead, and no effort has been made to segregate them. The gums of the cane molasses have been divided by one authority as follows:—*

> "The different gums which we have identified may be divided "into three classes:—(1) Those derived naturally from the cane, "such as xylan, araban, and galactan; (2) Those resulting from "fermentation changes in the juice, syrup, or molasses, such as "dextran, mannan, and cellulan; (3) Those produced by the "action of the clarifying agents during the process of manu-"facture."

In Table IV., given below, will be found the molasses arranged as before, according to the sucrose per 100 water, and also the gums per 100 water. With the exceptions of sample 2, 3, and 9, it will be seen that the fall in "gums per 100 water" fairly regularly accompanies a fall in "sucrose per 100 water." The viscid nature of the molasses is due mainly to these gums, but temperature also plays an important part, while certain salts, as for instance the chloride and nitrate of potash,

> "diminish in an exceptional way the viscosity of pure saturated "solutions; as a general rule for the same acids, salts of soda "increase the viscosity more than salts of potash, and salts of "lime more than salts of soda." †

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* C. A. Browne, La. Planter and Sugar Manufacturer, April, 1905.

† *International Sugar Journal*, June, 1903.

Table III.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Total Solids..........	75·08	78·69	81·89	75·34	75·34	79·06	75·06	81·80	80·85	79·36	81·66	81·80	82·57
Sucrose (Clerget).....	39·12	36·72	33·20	35·23	34·58	36·95	39·74	37·45	34·20	35·15	40·04	36·30	38·29
Real Purity	52·09	46·60	40·54	48·09	45·90	46·61	52·94	45·78	42·83	44·29	49·03	44·37	46·37
Glucose..............	6·04	8·92	11·16	15·82	21·55	8·84	12·54	17·31	11·36	14·12	15·01	13·33	18·00
Dextrose	3·00	4·97	5·70	7·21	11·05	4 60	6·20	8·30	5 60	6·22	7·46	..	7·80
Levulose	3·04	3·95	5·46	8·61	10·50	4·24	5·82	9·01	5·76	7·90	7·55	..	10·20
Ash (Sulphate)	8·36	8 36	11·17	8 39	9·21	13·99	8·47	10·47	10·73	15·14	..	13 18	11·44
Ash	8·41	8·32	11·76	7·89	8·46	13·25	8·22	11·47	11·24	13·44	11·36	14·52	13·43
Gums	9·91	9·64	12·63	6·68	4·89	9·09	7·89	8·98	11·51	10·44	12·21	8·55	7·82
Total Nitrogen......	·933	·364	·756	·421	·274	·600	·373	·440	·765	·529	·320	·413	·336
Albumenoid „	·080	·057	·078	·039	·045	·092	·046	·041	·062	·049	·030	·042	·046
Ammonia „	·026	·006	·032	·007	·006	·008	·004	·008	·029	·011	·002	·007	·007
Acidity 10/N Soda....	2·7	1·5	3·0	1·7	1·4	2·4	1·1	2·21	3·30	2·60	2·10	1·04	2·10
Chlorine	1·23	·64	2·14	2·15	2·37	3·12	2·20	2·47	1·98	2·70	2 49	2·99	3·28

Table III.—*Continued.*

	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Total Solids....	79·54	80·27	78·25	77·15	81·80	83·80	80·85	82·25	76·43	80·65	83·55	82 92	80·95	76·26
Sucrose (Clerget)	35·17	36·45	42·95	39·64	36·60	36·57	35·00	33·49	36·69	39·81	36·63	32·71	32·77	38·44
Real Purity...	44·22	45·41	54·89	52·67	45·18	43·73	43·04	40·72	48·00	49·36	43·84	39·45	40·48	50·40
Glucose........	21·18	19·61	6·67	14·37	13·97	7·55	14·51	18·90	10·08	6·74	20·83	18·38	8·90	14·71
Dextrose	9·09	..	3·42	8·01	7·02	3·70	6·97	9·40	5·76	3·87	10·18	9·42	3·78	6·70
Levulose	12·09	..	3·25	6·36	6·95	3·85	7·54	9·50	4·32	2·87	10·65	8·96	5·12	8·01
Ash (Sulphate) .	10 90	11·26	10·03	11·63	11·57	14·97	9·56	9·31	10·95	13·19	11·94	12 97	11·28	9·40
Ash	10·50	13·02	10·59	12·15	11·99	14·93	10·21	8·95	11·43	13·57	11·28	13·02	10·13	9·06
Gums..........	6·00	7·46	9·10	7·06	7·97	9·06	6·77	8·93	7·62	9·70	8·90	7·53	7·51	6·42
Total Nitrogen.	·353	·425	·570	·361	·473	·998	1·000	·911	·332	·457	·332	·483	1·001	·486
Albumenoid „	·045	·041	·042	·038	·041	·095	·108	·095	·038	·027	·029	·041	·050	·042
Ammonia „	·004	·008	·007	·006	·008	·011	·033	·030	·006	·011	·008	·011	·006	·003
Acidity 10/N Soda	1·40	1·60	3·40	2·20	2·10	2·70	3·60	3 60	3·60	3·80	3·40	3·60	4·08	3·80
Chlorine	2·41	2·38	2·03	2·23	2·31	2·99	1·53	1·53	2 20	2·67	2·12	2·15	·93	1·65

By reference to the analyses of the ashes given later on, it will be seen that a large part of the ashes of these molasses consists of chloride of potassium, thus already presenting the most favourable condition for the diminution of viscosity.

TABLE IV.

Number.	Water.	Sucrose.	Gums.	Sucrose per 100 Water.	Gums per 100 Water.
19	16·20	36·57	11·06	225·7	68·2
24	16·45	36·63	8·90	222·6	54·2
13	17·43	38·29	8·82	219·7	50·6
11	18·34	40·04	12·21	218·3	66·5
8	18·20	37·45	8·98	205·8	49·3
23	19·35	39·81	9·70	205·7	50·1
12	18·20	36·30	8·55	199·4	47·0
16	21·75	42·95	10·60	197·5	48·8
18	19·00	36·60	9·97	192·6	52·5
25	17·08	32·71	8·58	191·5	50·2
21	17·75	33·49	8·93	188·7	50·3
15	19·73	36·45	7·46	184·8	37·8
3	18·11	33·20	12·63	183·3	66·1
20	19·15	35·00	6·77	182·8	35·5
9	19·15	34·20	11·51	178·6	57·1
6	20·94	36·95	8·09	176·4	38·6
17	22·85	39·64	7·06	173·5	30·9
2	21·31	36·72	9·64	172·3	43·4
14	20·46	35·17	7·50	172·1	36·7
26	19·05	32·77	7·51	172·0	39·4
10	20·64	35·15	8·44	170·3	36·0
27	23·74	38·44	7·42	161·9	31·2
7	24·94	39·74	7·89	159·4	31·5
1	24·91	39·12	8·91	157·0	36·8
22	23·57	36·69	7·62	155·6	32·3
4	24·66	35·23	6·68	142·8	27·1
5	24·66	34·58	4·89	140·2	19·5

To rid ourselves of the gums, then, would seem to be one method of making possible the recovery of more sugar. We have many agents at hand for this purpose, but unfortunately the use of them is prohibitive either on account of their poisonous nature or great cost.

The possibility of the recovery of sugar from sorghum by the precipitation of the gummy impurities by alcohol has already been demonstrated by the U.S. Department of Agriculture. The practice of this method on the large scale has hitherto been interdicted by the high price of the alcohol, and the impossibility of preventing some loss. With the passage of the Act enabling the manufacture of denatured spirit, this objection has been overcome, and we have further the material at hand for the manufacture of the alcohol.

To learn the effects of alcohol on our molasses, sample number 1 was treated with alcohol in the proportion of two of 95% alcohol to one of molasses. After decanting the clear liquid from the copious precipitate, it was evaporated under vacuum. The resulting massecuite analysed as follows, it being tabulated with the original molasses for convenience of comparison :—

	Total Solids.	Sucrose Clerget.	Real Purity.	Glucose.
Molasses	75·08	39·12	52·09	6·04
Masse-cuite	77·00	41·75	54·2	6·25

The difference in purity is not great, yet after standing ten days, a splendid crystallization resulted. A study of the nature of the gums removed by the alcohol, showed that in a general way they are similar to those eliminated by subacetate of lead. Thus, any process which can economically remove or reduce the amount of the gummy impurities, will increase the amount of recoverable sugar. An opportunity is presented for accomplishing this in part when the molasses is steamed for the purpose of dissolving false grain and facilitating handling. The heavy scum or froth which rises to the surface is usually of a much less purity than the molasses which is under it. We have been able to examine three such scums and the molasses from which they originate, and their purities compare as follows :—

	A.	B.	C.
Scum	35·40	37·1	18·2
Molasses	36·37	39·4	25·6

Thus there is possible a more or less considerable improvement of the molasses at this point of manufacture, provided the scum is removed. It is strongly recommended that this mass of impurities be discarded and not again passed through the process of boiling, as is unfortunately frequently the case.

No other methods of removing the gathered impurities in the molasses by means of chemical agents suggest themselves at this time.

TABLE V.*

No.	Silica.	Iron and Alumina.	Lime.	Magnesia.	Potash.	Soda.	Sulphuric Anhydride.	Phosphoric Anhydride.	Chlorine.	Carbon Dioxide.	Total.	Less Oxygen = Chlorine.	Total.
1	·24	..	15·56	9·13	28·90	1·44	11·90	2·88	14·58	18·93	103·56	3·28	100·28
2	1·24	1·90	21·95	11·85	14·62	1·39	13·36	1·90	8·22	25·43	101·86	1·81	100·01
26	3·44	1·86	24·26	7·85	16·45	1·62	14·88	2·18	9·13	19·50	101·17	2 05	99·12
3	1·49	3·31	9·31	9·97	29·63	·90	15·36	3 30	16·21	14·31	103·79	3·65	100·14
9	1·76	2·91	9·70	9·04	31·59	2·01	15·67	3·57	16·16	11·02	103·43	3 62	99·81
16	1·04	1·64	12·70	6·62	32·41	2·02	11·73	1·52	19·16	16·07	104·91	4·31	100·60
20	3·62	3·53	6·46	9·75	32·40	1·90	17 81	3·86	14·96	9·78	103·67	3·37	100·30
21	3·71	2·04	9·68	7·30	34·59	1·86	13·37	2·51	17·11	12·14	104·31	3 85	100·46
27	3·28	4·95	3·21	4·66	41·53	1·98	7·84	7·37	18·25	10·13	103·20	4·10	99·10
7	·54	·91	9·96	7·03	36·24	3·30	4·29	1·02	26·86	15 87	106·02	6·04	99·98
23	·85	·88	17·32	3·91	31·93	2·22	10·68	·79	19·67	15·70	103·95	4·42	99·53
19	1·25	1·63	8·75	9·27	34·78	1·53	12·50	1·17	20·03	14·05	104·96	4·51	100·45
25	2·12	1·25	10·50	6·71	36·06	1·80	12·03	1·25	16·51	15·37	103·60	3·71	99·89
4	2·54	1·47	3·68	5·58	42·19	3·30	5·20	1·87	27·29	12·76	105·88	6·14	99·74
11	1·60	·60	8·33	2·38	47·21	3·29	4·46	1·03	21·96	13·82	104·58	4·95	99·63
24	2·21	2·00	6·24	3·74	45 13	1·80	8 85	2·02	18·80	13·09	103·88	4·23	99·65
6	1·43	·98	9·68	4·67	39·66	1·69	10·25	1·30	23·56	12·22	105·44	5·30	100·14
22	1·71	1·10	10·52	3·77	41·79	2·00	10·33	1·13	19·25	13 30	104·90	4·33	100·57
5	2·00	1·32	6·97	5·93	39·10	2·75	7·82	1·68	26·65	11·81	106·03	6·00	100·03
18	3·66	1·91	11·74	7·83	32·05	1·95	13·14	1·23	19·25	11·86	104·62	4·33	100·29
8	·86	1·05	7·52	6·75	37·09	3·73	12·91	1·05	21·50	12·88	105·34	4·84	100·50
13	2·04	·85	9·39	6·01	34·64	3·19	11·87	·77	24·40	12·54	105·70	5·49	100·21
14	3·57	·42	7·38	8·70	33·85	2·94	12·48	1·05	22·98	11·15	104·62	5·17	99·45
10	1·16	·81	6·52	6·10	39·98	2·89	13·04	1·10	20·06	12·92	104·58	4 51	100·09
17	2·50	·67	11·42	4·94	36·19	1·90	12·43	1·00	18·37	14·50	103·92	4·13	99·79
12	1·75	1·70	7·09	3·53	42·46	2·35	10·82	2·08	20·57	12·24	104·59	4·63	99·96
15	1·90	3·17	8·55	4·57	40·08	1·13	9·77	2·54	18·25	14·59	104·55	4·11	100·44

* The first nine molasses are from Hawaii, the next four from Kauai, the next five from Maui, and the balance from Oahu.

TABLE VI.

No.	Silica.	Iron and Alumina.	Lime.	Magnesia.	Potash.	Soda.	Sulphuric Anhydride.	Phosphoric Anhydride.	Chlorine.	Carbon Dioxide (in Ash).
1	·020	..	1·309	·768	2·430	·121	1·001	·242	1·226	1·592
2	·103	·158	1·826	·986	1·216	·116	1·116	·158	·644	2·116
26	·349	·188	2·458	·795	1·666	·164	1·507	·221	·925	1·975
3	·175	·389	1·095	1·172	3·484	·106	1·807	·388	2·137	1·683
9	·198	·327	1·090	1·016	3·551	·226	1·761	·401	1·983	1·239
16	·110	·174	1·344	·701	3·432	·214	1·242	·161	2·030	1·702
20	·370	·360	·660	·995	3·308	·194	1·818	·394	1·527	·999
21	·332	·183	·886	653	3·100	·166	1·197	·225	1·531	1·087
27	·297	·448	·291	·422	3·763	·179	·710	·668	1·654	·918
7	·044	·075	·819	·578	2·979	·271	·353	·084	2·200	1·305
23	·115	·119	2·340	·531	4·333	·301	1·479	·107	2·670	2·130
19	·187	·243	1·306	1·384	5·193	·228	1·866	·175	2·991	2·098
25	·276	·163	1·367	·874	4·695	·234	1·566	·163	2·150	2·001
4	·200	·116	·290	·440	3·329	·266	·410	·146	2·153	1·007
11	·182	·116	·946	·270	5·360	·370	·500	·117	2·490	1·560
24	·249	·226	·704	·422	5·091	·203	·998	·228	2·120	1·477
6	·189	·130	1·283	·619	5·255	·224	1·358	·172	3·120	1·619
22	·195	·126	1·202	·431	4·777	·229	1·181	·129	2·200	1·520
5	·169	·112	·590	·502	3·308	·190	·577	·142	2·369	1·000
18	·439	·229	1·408	·939	3·842	·234	1·575	·147	2·308	1·413
8	·099	·120	·863	·774	4·254	·428	1·481	·120	2·465	1·477
13	·274	·114	1·201	·807	4·652	·428	1·594	·103	3·277	1·684
14	·375	·044	·775	·914	3·554	·309	1·310	·110	2·413	1·171
10	·156	·109	·876	·820	5·373	·388	1·753	·188	2·702	1·736
17	·304	·081	1·388	·600	4·397	·231	1·510	·122	2·232	1·762
12	·254	·247	1·029	·513	6·163	·341	1·571	·302	2·986	1·777
15	·248	·413	1·113	·595	5·218	·147	1·272	·331	2·376	1·900

In Table V. will be found the analyses of the ashes of the molasses. They are arranged according to the islands whence they came, and those bracketed are from the same factory. In Table VI. the ash constituents are given in per cent. of the molasses. The silica and

iron and alumina are mainly accidental components of the ashes, depending on the condition of the cane when coming to the mill, the method of clarification, the time given for the settling of the scums, and the impurities present in the lime used in clarification.

The lime is found to be naturally greatly affected by the amount used in clarification. For the purpose of comparison, we append the lime percentage of the ashes of several samples, placed in comparison with the pounds of lime used per ton of juice:—

	Lime per cent. Ash.	Lime per cent. Molasses.	Lbs. Lime, per ton Juice.
2 and 20	22·0	1·642	1·93
17	11·42	1·388	1·77
16	12·70	1·344	1·73
11	8·33	·946	1·66
18	11·74	1·408	1·17
21	9·68	·866	1·12
22	10·52	1·202	·90
13	9·39	1·261	·89
20	6·46	·660	·76

The potash content of the ashes varies from 8·22% to 47·21%, and of the molasses from 1·216% to 6·163%. As will be seen in Table VII., this variation follows very closely that of the chlorine, resembling in this respect the molasses of Java, of which Mr. Prinsen Geerligs says:—

> "A high chlorine content always coincides with a high amount "of potash, while the amount of soda is always insignificant, "although the chlorine had originally occurred in combination "with that element."*

TABLE VII.

No.	Potash.	Chlorine.	Soda.	No.	Potash.	Chlorine.	Soda.
2	1·216	·644	·116	8	4·254	2·465	·428
26	1·666	·925	·164	23	4·333	2·670	·301
1	2·430	1·226	·121	17	4·397	2·232	·231
7	2·979	2·200	·271	13	4·652	3·277	·428
21	3·100	1·531	·166	25	4·695	2·150	·234
20	3·308	1·527	·194	22	4·777	2·200	·229
5	3·308	2·369	·190	24	5·091	2·120	·203
4	3·329	2·153	·266	19	5·193	2·991	·228
16	3·432	2·030	·214	15	5·218	2·376	·331
3	3·484	2·137	·106	6	5·255	3·120	·224
9	3·551	1·983	·226	11	5·360	2·490	·370
14	3·554	2·413	·309	10	5·373	2·702	·388
27	3·763	1·654	·179	12	6·163	2·986	·341
18	3·842	2·308	·234				

* *International Sugar Journal*, December, 1905.

The chlorine content is in a general way an indication of the source of the molasses. It varies from ·644% to 3·277% in the different samples, but those from the same factories do not show such extensive variations in this element as are found in the others. A low chlorine content indicates that the molasses originates from canes grown with natural rainfall, and of these the highest are those from plantations having their lands near the coast, and receiving more or less the spray of the ocean during the heavy trade winds. Those with a high chlorine percentage are generally from lands under irrigation, and the more brackish the water used for that purpose, the more chlorine will be found in the juices, and consequently in the molasses. The effect of varying quantities of salt in the irrigation water on the juices was demonstrated in experiments at this station, with results as follows:—*

Salt per Gallon of Irrigation Water.	Chlorine, per cent. Juice.	Chlorine, Grains per Gallon Juice.
50 grains	·0520	30·212
100 ,,	·0758	44·040
150 ,,	·0778	45·086
200 ,,	·1010	58·681

There is considerable difference in the amounts of sulphuric anhydride present, due doubtless to the varying amounts of sulphate fertilizers applied, and to the different varieties of cane represented, as also the amounts of sulphuric oxide compounds existing in the soils. The ash of the cane itself may contain all the way from 2·61% to 10·55% of this element, so we should naturally expect to find considerable differences in the juices and molasses.

The figures given under carbon dioxide do not mean that those amounts of this matter are in the molasses, but are calculated from the percentages in the carbonated ash. Naturally, with an acid liquid, no carbonates could be present. The amounts of carbon dioxide as given can be taken as representing the quantities of organic acids existing in the molasses, in combination with the various bases.

Summary.

1. The ratio of glucose to ash does not serve as an indication of the exhaustion of the Hawaiian molasses.

2. The limit of the further recovery of sugar is established principally by the viscosity of the molasses.

3. The viscosity of the molasses originates with the gums, and any method reducing the quantity of gums or their stickiness, makes for the possibility of further recovery of sugar.

4. The ashes of molasses and the composition of the ashes vary with the conditions of growth of the cane and the amounts of lime used in the clarification of the juices.

5. A high salt content in the irrigation water increases the potash and chlorine in the ash, but not to an appreciable extent the soda with which the chlorine was originally combined.

* Bulletin No. 9, Division of Agriculture and Chemistry, H. S. P. A.

INDIAN SUGAR.

S. M. Hadi's System of Sugar Manufacture.

Mr. S. M. Hadi, M.R.A.C., Assistant Director of Land Records and Agriculture, U.P., who was deputed by the U.P. Government to the Industrial Exhibition, has been demonstrating his interesting process of manufacturing and refining sugar. The process has been developed by himself in the course of his official studies of the subject in his own province, and is intended for the improvement of a great Indian industry which the Germans with their beet sugar have been threatening to ruin. His installation is meant primarily for the small native capitalists now engaged in the industry, whose resources do not enable them to go in for a more extensive plant, and especially for those tracts where cane is grown in such small lots by numerous individuals that the working of a large factory presents exceptional difficulties; but the methods can be adapted conveniently to the requirements of an individual or a Corporation desirous of investing a large capital. Mr. Hadi extracts the juice by improved three-roller mills worked by bullock power. The juice is collected in a tin receptacle placed at the foot of each mill, passing through perforated sheet iron strainers, while flowing into those vessels. The boiling apparatus consists of: (*a*) a reserve tank made of galvanized iron, in which the juice is heated directly after it comes from the mill; (*b*) a clarifier made of copper or brass, in which the juice transferred from the reserved tanks is defecated by the addition of an extract of the wild plant *deula* (hibiscus esculentus) and some *sajji* (crude carbonate of soda); (*e*) a concentrator, made of copper or brass, into which the juice is allowed to go from the clarifier to boil; and (*d*) an evaporator, of the same material, which consists of several compartments and in which the juice acquires the consistency of *rab* or *gur* as it is called in Bengal.

The latter material is allowed to cool for several days till the sugar has crystallized out, and is then put into centrifugal machines, which may be worked either by hand power or steam. In this way the sugar is separated from the molasses. While being cured the sugar is sprinkled with a decoction of the *reetha* fruit (soap-nut) which makes it a milk white. The molasses, thus separated from crystallized sugar, is again boiled down to *gur*, which may fetch Rs.3½ or more per md.* in the Calcutta market. The boiling plant is capable of working 80 mds. of juice into *rab* or *gur* in the course of a day. It costs about Rs. 500 if made of brass or Rs. 600 if of copper. The handpower centrifugal costs about Rs. 425 in Calcutta and works out about 5 mds. of *rab* into sugar per day.

Under Mr. Hadi's method 100 mds. of juice yield from 19 to 21 mds. of *rab* or *gur*, and 100 mds. of *rab* or *gur* produce about 50 mds.

* 1 maund = 82⅞ lbs. or 37·3 kg.

white raw sugar. On the average, 100 mds. molasses when boiled again give about 70 mds. of *gur*. The raw sugar is boiled again with milk and water to form *masse-cuite*. This material is again pressed through the centrifugal to yield (1) a crystallized white refined sugar (2) a syrupy treacle. The latter is again boiled and converted into 2nd grade crushed sugar. One hundred mds. of raw sugar produced by the above method yield ordinarily 50 mds. of refined crystallized sugar and 38 mds. of 2nd grade crushed sugar.

The profits in the sugar manufacture according to Mr. Hadi's system, under conditions prevailing in the United Provinces, are calculated at 20 to 25 per cent. on the total outlay. Mr. Hadi has had no opportunities of familiarizing himself with the Bengal conditions, and he has, therefore, supplied the figures which apply to his own provinces, but which cannot differ materially from those which will work out in other parts of the country. The public interested in the sugar industry may refer to Mr. Hadi for further particulars. He is prepared to teach a few selected candidates free of charge. No patent has been taken out by the inventor, as his object is to benefit the sugar industry in India, and not any personal gain.—(*Indian Daily News.*)

RECENT IMPROVEMENTS IN BEET-DIFFUSION, AND THEIR PRACTICAL AND ECONOMIC INFLUENCE ON THE CRISIS IN THE SUGAR INDUSTRY.

By M. A. Aulard.

(Continued from page 99.)

As M. Naudet has himself described his process I need only call your attention to the advantages gained by heating the juice which enters the terminal diffuser of the battery; an arrangement common to the Naudet and Steffen processes.

The object of the Naudet process is to obtain a juice of high purity and density whilst reducing the number of diffusers in the battery; also to secure the highest possible extraction when the volume of juice drawn off is reduced to 96 or 100 litres (maximum) per 100 kilos of beets. Although this process does not eliminate the waste-waters from the diffusers and cossette-presses, these waters contain so little sugar as compared with the ordinary diffusion process that, in this respect, their value is quite negligible.

As the Steffen process necessitates an entire re-arrangement of the sucrerie which is rarely possible or even desirable, the Naudet process, being merely a modification of existing methods, deserves careful consideration. It will be some time before our fabricants are convinced that Germany, once more, is ahead of us, as was the case

with the ordinary diffusion process, crystallization in motion, and most modern methods. During the coming campaign, no less than 12 or 15 German sucreries will adopt the Steffen process—a fact which, in my opinion, signifies much. But, not to anticipate matters, I return to our colleague Naudet, whose process has emerged from its chrysalis and is now ready to take flight.

If the results obtained by this process have been disappointing in certain usines owing to unfavourable working conditions, they have proved entirely satisfactory elsewhere as at Nassandre, under the control of M. Bouchon, and at Mesnil under M. Eclancher, who has very kindly placed his results at my disposal. In a Belgian sucrerie, where the process has been in operation for three years under the competent direction of one of our colleagues, the consumption of coal has been reduced to 66 kilos per ton of roots, although this usine turns out only high-grade crystals with a yield of not less than 13·0%. The diffusion juice had a density of from 6·3 to 6·8, and, being very free from albumen, was easily worked up into masse-cuite. The circulation of the juice being more rapid (as recommended by M. Vivien) the output of the battery is appreciably increased. The formation of gas due to fermentation has entirely disappeared, as also the greater part of the "undetermined losses," thus realizing the maximum yield of sugar without abandoning the diffusion battery.

It is a familiar fact that when the terminal diffuser and its contents are heated to 80° or even 85°C. the resulting juice is very limpid and has a purity 2° or 3° higher than that obtained under ordinary working conditions, yet this increase in purity does not result in a corresponding increased yield of sugar, because the impurities removed are organic rather than saline. The purity of the diffusion juice obtained by the Naudet process may be estimated at from 1° to 1½° higher than that obtained from the same roots by the ordinary method of diffusion, hence, it may be said that the process diminishes the output of molasses, so that in addition to reducing the losses of sugar during diffusion it permits an additional gain of sugar which would otherwise be lost in the molasses. So far as our present technical knowledge goes, the Naudet process is undoubtedly that which extracts the most sugar at the lowest cost. Does it, then, follow that this process (which has received the approval to which every inventor aspires) is the only one in which the juice is heated in the terminal diffuser of the battery? No. There are others, but I will mention only two, as I have yet much to say before I conclude. In the quarterly *Bulletin du Syndicat des Fabricants de Sucre de France* (March, 1906) M. Saillard describes his visit to the sucrerie of Boehmisch-Brod, in the company of M. M. Trollé and Bertrand Frédéric, to inspect the Hyros-Rak battery for continuous diffusion.

This battery comprises six diffusers which externally resemble Skoda presses. Each diffuser is 5·63 metres high, and comprises

three parts—a cylindrical portion, a conical portion, and a second cylindrical portion of less diameter than the first. Within each diffuser is an Archimedean screw which rotates at variable speeds. As in the Naudet process, the juice is heated in the terminal diffuser as follows:—The juice is pumped from the top of diffuser No. 2 into a receiving tank whence it flows into diffuser No. 1 filled with fresh cossettes, after passing through a juice-heater. M. Saillard concludes his description of the Hyros-Rak battery by remarking that whereas water and fresh cossettes enter (as in the ordinary diffusion battery), only diffusion juice and pressed cossettes pass out.

The Hyros-Rak battery, which appears to be very costly, eliminates the losses of sugar due to the waste waters and the many inconveniences resulting from these. But the "undetermined losses" are not sensibly diminished, and the time during which the pulp remains in the battery is much too long.

Although this process attracted the attention of the first Commission of the *Syndicat des Fabricants de Sucre de France*, I dare not prophesy as to its future, having in mind the rival processes of Steffen and Naudet, and the fact that in the latter process the ordinary diffusion battery only requires modifications.

As I have already said, some fifteen usines will adopt the original Steffen process during the coming campaign. According to the *Sucrerie Indigène et Coloniale*, No. 5, 1906, Steffen patented a modification whereby a higher extraction of the pulp and a greater concentration of the juice were secured by the use of several macerating vessels arranged one behind the other, through which the partially extracted pulp was caused to pass and thus subjected to continuous maceration, a temperature of from 80 to 100° C. being recommended.

This, however, is not the Steffen process which we saw in operation three years ago at the Bruhl Sucrerie, near Cologne. At that time, the process was yet in its infancy and Steffen's claim so astounding that we returned from our scientific expedition disillusionized.

To-day, the Steffen process has entered on a new phase, giving rise to some anxiety lest the experience of thirty years is to count for nothing; a period which has seen the gradual disappearance of the continuous or hydraulic-press. But I consider that the diffusion battery of to-day is already doomed and that its ultimate disappearance will only be postponed by reason of the high yields obtainable by the Naudet process and the small outlay required.

Although I have taken up much of your time it remains to indicate the essential principles of the Steffen process, and to analyse the report of Prof. Hansen, of Bonn, which appeared in the "*Mittheilungen der Deutschen Landwirtschafts Gesellschaft*" for April 28th, 1906.

The Steffen process, as installed in the German Sucreries of Bruhl (near Cologne), Euskirschen (Rhenish Province), Altfelde (Eastern Prussia), Gostyn (District of Posen), Teterow (Mechlemberg), and

Oschalz (Saxony), is carried out as follows:—The roots are sliced in the ordinary machines, the slices being from 1 to 2 mm. in thickness, thus differing from the cossettes as prepared for ordinary diffusion. These slices are then rapidly heated until their temperature is raised 90° C. This sudden application of heat throughout the mass of slices transforms the cellulose into a kind of vegetable parchment. The quantity of heat required per kilo of sliced roots is approximately 500 calories, and is applied in the form of raw juices at the boiling point; the proportion of juice to slices being such that the temperature of the mixture is about 85° C. As the interchange of heat is almost instantaneous, the sliced roots are rapidly heated through 75° C.

During this operation the cellular juice is set free, the albumen of that juice is coagulated, and the solid matters brought into a suitable condition for subsequent pressing.

The slices are then rapidly removed from the macerating vessel by means of a helical elevator and are pressed in the usual cossette-presses, at a temperature of 85° C., yielding juice and pressed pulp. Whereas, in the ordinary process of diffusion, the extraction of the juice occupies 2¾ hours, as M. Vivien has proved, in the Steffen process the sliced roots are in contact with the hot juice for a few minutes only. Consequently, this contact is too brief to allow the cellular structure of the slices to be destroyed by the expansion of certain constituents of the juices which remain in the pressed pulp instead of mixing with the juice and lowering its purity. At the same time, the pulp is rendered more suitable for pressing.

Everyone connected with the sugar industry must admit that, in the Steffen process, the principle of osmosis has been utilized with the highest possible efficiency; the sliced roots being deprived of their sugar but retaining the saline and organic impurities.

The juice escapes from the presses at a temperature of 80° C. and is reheated to 100° C. before re-entering the macerating vessel where it comes in contact with the fresh slices. As the quantity of juice thus circulating between the macerating vessel and the cossette-presses gradually increases, there is always more juice than that actually required for the maceration, and this excess of juice passes continuously to the carbonatation tanks, with a density of about 1073 (18° Brix) and a purity of 96·0. Its subsequent treatment is less troublesome and costly than in the case of juice obtained by ordinary diffusion.

The pressed pulp is discharged from the presses at a temperature of from 80° to 82°C., and represents somewhat less than 28% of the weight of roots treated; it contains from 33 to 34% of dry matter containing from 8 to 10% of sugar. As the pressed pulp contains only from 58 to 60% of water it is more easily dried in the drying apparatuses now in use than the wet cossettes obtained in ordinary diffusion.

Dr. Hansen has compared the results obtained by this process at the six usines already mentioned; five of which furnished him with comparative data as under:—

	Altfelde. Per cent.	Bruhl. Per cent.	Gostyn. Per cent.	Oschatz. Per cent.	Teterow. Per cent.
Sugar in the Beets ..	15·5	14·0	16·0	14·5	14·9
Steffen Process.					
First Jet	11·56	10·50	12·60	12·00	10·80
Low-grade Sugars	0·60	0·50	0·50	0·20	0·70
Molasses	1·70	1·50	0·80	0·30	1·50
Dried Pulp	11·08	11·00	11·30	11·30	11·40
Ordinary Diffusion.					
First Jet	13·10	11·30	14·12	13·10	12·20
Low-grade Sugars	1·00	1·00	1·00	0·70	1·30
Molasses..	2·60	3·00	2·00	2·00	2·80
Wet Cossettes	50·00	—	—	55·00	—
Dried Cossettes	—	6·00	6·00	—	6·00

All the results agree in proving that in the new process less sugar is recovered as first jet and low-grade sugars than by ordinary diffusion, which is unavoidable. It will also be observed that less molasses are obtained, the percentage of molasses in beets varying from 0·3 to 1·7, whereas, in ordinary diffusion, the percentage varies from 2·0 to 3·0. The deficiency of sugar in the crystallized produce and molasses is found in the dried pulp, the nutritive value of which is thereby increased. The percentage of dried pulp varies between 11·0 and 11·4.

Concerning the commercial value of the process, Dr. Hansen adopts the following valuations, which are by no means favourable to the Steffen process:—

	Francs.
100 kilos of first jet sugar	22·50
Low-grade Sugars	18·50
Molasses	7·50
Wet Cossettes (ordinary diffusion)..	0·75
Dry ,, ,, ,, ...	9·37
Dried Pulp (Steffen process)	12·50

We have previously mentioned that Dr. Claassen estimated the value of the pulp obtained in his process at 11 francs.

In estimating the cost of drying it will be sufficient to allow 0·06 marks per 100 kilos of roots. Admitting these valuations we deduce the following profits resulting from the Steffen process:—

Steffen Process.		Altfelde. Per cent.	Bruhl. Per cent.	Gostyn. Per cent.	Oschatz. Per cent.	Teterow. Per cent.
First Jet	at 22·50	260·10	236·25	283·50	270·00	243·00
Low-grade Sugars	,, 18·50	11·10	9·25	9·25	3·70	12·95
Molasses..	,, 7·50	12·75	11·25	6·00	2·25	11·25
Dried Pulp.. ..	,, 12·50	183·50	137·50	141·25	141·25	142·50
		422·45	394·25	440·00	417·20	409·70

Ordinary Diffusion.

First Jet	at 22·50	294·75 ..	254·25 ..	317·70 ..	294·75 ..	274·50
Low-grade Sugars	,, 18·50	18·50 ..	18·50 ..	18·50 ..	12·95 ..	24·05
Molasses	,, 7·50	19·50 ..	22·50 ..	15·00 ..	15·00 ..	21·00
Wet Cossettes ..	,, 0·75	37·50 ..	— ..	— ..	41·25 ..	—
Dried Cossettes ..	,, 9·37	— ..	56·22 ..	56·22 ..	— ..	56·22
		370·25	351·47	407·42	363·95	375·77
Difference in favour of the Steffen process		52·20 ..	42·78 ..	32·58 ..	53·25 ..	33·93
Less cost of drying the Pulp		6·00 ..	— ..	— ..	6·00 ..	—
Profit		46·20	42·78	32·58	47·75	33·93

Assuming that the working expenses are the same as in ordinary diffusion, the Steffen process shows a profit of from 32·58 to 47·75 francs per ton of roots. This is readily understood in view of the fact that a much smaller volume of juice has to be worked up, so that the factory operations are reduced by about 20%, and also facilitated by the high purity of the juice.

Dr. Hansen adds:—"I am convinced that the development of the Steffen process is of enormous interest to cultivators of the beetroot and manufacturers of sugar. Unfortunately, in the present condition of the sugar industry few are willing to incur the expenses of new machinery, and this explains why the Steffen process has not been more largely adopted. But as everything must have a beginning, we find that 5% of the German sucreries will utilize this process next year."

Dr. Hansen refers at some length to the nutritive value of the dried pulp obtained, containing from 30 to 40% of sugar, and which must not be confused with the ordinary cossettes containing only 10% of sugar. The following analysis will indicate the composition of the Steffen product:—

Locality.	Solid Matters %	Crude Protein %	Albumen %	Oil %	Non-Nitrogenous Extractives. Total %	Sugar %	Fibre %	Ash %
1. Brühl	91·78	7·09	6·91	0·0	69·70	39·71	12·82	3·97
2. ,, ...	93·22	7·22	6·55	0·30	69·20	39·70	12·82	3·67
3. ,, ...	91·10	7·57	6·75	0·53	67·44	37·93	12·16	3·40
4. ,, ...	93·05	7·68	6·80	0·37	69·99	39·78	12·13	2·88
5. Euskirchen ..	89·67	6·70	5·51	0·49	63·34	41·16	11·32	7·82
6. ,, ..	91·71	7·39	6·22	0·28	69·89	35·02	11·77	5·35
Mean of 6 ..	91·75	7·27	6·36	0·39	67·76	38·88	12·17	4·52
7. Altfelde	90·40	6·30	—	0·50	68·60	35·50	10·50	4·50
8. Gostyn	90·76	5·78	—	0·34	70·86	32·80	10·92	2·86
Mean of 8 ..	91·46	6·97	—	0·40	68·25	37·70	11·81	4·31

The digestibility of the Steffen pulp has been investigated by Hagemann, who proved that 76% of the organic substances are digestible; namely, 3·8% of protein, 6·7% of fibre, and 55·6 of non-nitrogenous extractives. Killner regards these figures as under-estimated, because Hagemann examined a sample deficient in protein, and give his own estimates as follows:—3·4% of protein, 8·7% of fibre, and 58·9% of non-nitrogenous extractives. The pulp contained 20% of digestible albumen which, on an estimate of 80·0%, would give an actual value of 55·2%. I refrain from quoting the results of feeding trials, as these would detain us too long.

Dr. Hansen concluded his remarkable report as follows:—"I trust I have succeeded in proving the agricultural and industrial significance of the Steffen process. Every attempt to restore the former prosperity of the sugar industry deserves our whole attention. I need not refer to the misfortunes which followed the compulsory reduction in beet cultivation, it being obvious that agriculture is wholly dependent upon the sugar industry, although this is, unfortunately, too often forgotten.

"The Steffen process renders it possible to relieve the sugar markets without reducing the quantity of beets cultivated; and the method adopted by Steffen consists in utilizing a part of the sugar contained in the roots for the production of a fodder of great value. The various cattle-foods manufactured from molasses cannot, and never will, serve as a substitute for the saccharine pulp owing to certain objectionable constituents of the molasses which are entirely absent in the pulp."

Having now brought forward all the evidence, allow me to state my own conclusions.

Much must be left unsaid, and many interesting researches connected with the losses known or unknown, partial or total, must remain unquoted. I have re-read these with pleasure, and if you will do the same you will be equally convinced that Steffen is misunderstood when he is supposed to claim that his process extracts more sugar than is actually present in the beet. But he can say—"My process eliminates those losses of sugar which are generally undetermined, or determined only when discovered. Consequently, I finally obtain one per cent. more sugar than is generally obtained by ordinary diffusion." This is perfectly intelligible to chemists, like ourselves, for it cannot be denied that we lose more sugar than we think, and than can be detected by the imperfect methods of investigation adopted in the majority of industrial laboratories.

When an important sucrerie, such as Dormagen, records known losses of 1·57, 1·50, and 1·23, with undetermined losses of 0·87, 0·77, and 0·64, one can place little reliance on the economic efficiency

of the majority of sucreries. We are inclined to agree with Prof. Claassen's estimate that, taking the bad years with the good, we lose 1·25% of sugar on the weight of roots, without reckoning the loss of sugar due to the production of an excess of molasses by faulty extraction; that is to say, the lowering of the purity of the juice by 2° or 3° owing to the extraction or organic and saline impurities during protracted diffusion. In the Naudet and Steffen processes, these losses are diminished by about 1·0%, so that the above claim is fully justified.

In the Naudet process this gain of 1·0% appears in the manufactured sugar, whereas in the Steffen process it is left in the pressed pulp. In choosing between these two processes it should be stated that the Naudet process can be easily adapted to the diffusion batteries now in use at a cost of about 6,000 francs, or a total cost of from 12,000 to 14,000 francs. In the case of the Steffen process radical alterations must be made in your factories, costing about 200,000 francs, which sum will be advanced by the *Société des Brevets Steffen* to be repaid out of the profits thus realized, which is a sufficient guarantee of success.

The Naudet process does not avoid the old problem of how to deal with the waste-waters, which are so liable to decomposition because charged with albumen. But, in adopting the Naudet process, one may adopt either of the methods proposed by Claassen and Pellet for purifying these waste-waters, so that they may be further utilized.

The Steffen process, on the other hand, is a revolution in the methods of manufacture as complete as that which formerly occurred when the primitive method of extraction by presses gave place to the method of diffusion. That happened early in my career, but I well remember that the beet cultivators at first refused to accept the diffusion pulp at any price, and were only made to understand its value by means of lectures, pamphlets, and numerous experiments, such as those carried out by Vivian, Pellet, Simon-Legrand, and others.

Cultivators are now equally convinced of the nutritive value of the saccharine pulp obtained in the Steffen process. In brief, the only way to prevent the wholesale loss of nutritive materials is to dry the pulp, selecting a suitable apparatus for this purpose from those now on the market; Butner and Meyer, Lafeuille, Huillard, &c.

I have endeavoured to treat the subject of this paper without bias, and hope this will be recognised by my readers, as also by the various authors whose works I have referred to.—(*Bulletin des Chimistes.*)

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Abridgment.

12227. J. Takamine, of New York, U.S.A. *Diastatic substance and method of producing same.* 25th May, 1906. This invention relates to the process of producing a diastatic substance, which consists in making a fluid extract of grains, cereals, tubers or the like, or of such material after removal therefrom of the whole or a part of their starchy constituents, by treating such materials for from about five to six hours, and adding the extract so obtained in desired quantity to a substance having starch-liquifying properties.

GERMAN.—Abridgments.

176175. Tozaburo Suzuki, of Sunamura, Japan. *Vacuum apparatus more particularly for the sugar industry.* 17th February, 1905. This vacuum apparatus is provided with revoluble distributing discs and heating bodies forming evaporating surfaces arranged beneath them, which bodies consist of horizontal concentrically lying heating pipes, and is characterized by the distributing discs being provided with vanes against which a jet of the liquid to be evaporated is conducted, in order to set the discs in rotation at a speed corresponding to the quantity of liquid introduced. Another form of the vacuum apparatus described is characterized by the arrangement of heating tubes being there arranged displayed one above the other, in such a way that each upper one covers the interval between the next for the purpose of providing as large an evaporating surface as possible.

176173. Dr. Th. Mauritz, of Düsseldorf. *Process and apparatus for freeing beetroot shreddings from water.* 7th February, 1906. This method of freeing beetroot shreddings from water by means of disintegrating and pressing is characterized by the shreddings being first comminuted and then pressed, the pulp which has been pressed through being dehydrated in a fine sieve press, and the pressed cakes from both presses combined before being dried by heat. The apparatus for carrying out the process just described comprises a spindle press (of the Klusemann pattern) with a grinding device arranged directly under the feed hopper, and consisting of two grinding discs arranged concentrically to the spindle, and by a fine sieve press located directly beneath this grinding device for treating the pulp discharged from the first press.

176930. Fernand Lafeuille, of Quessy, France. *Annular mould for casting sugar slabs.* 13th November, 1904. In this annular mould for casting sugar slabs, the chambers for receiving the masse-cuite alternate with chambers which are provided with a circulation wall for receiving the cooling or heating medium, and the

characteristic feature is that the upper cover of the mould is provided with channels or passages for the admission and discharge of the cooling or heating medium.

178613. HEINRICH HENCKE, of Berlin. *Roller press for freeing disintegrated substances from water, more particularly extracted beetroot shreddings.* 23rd August, 1904. This roller press is characterized by the feed of the materials in front of an auxiliary suction roller taking place at one point of the main suction roller at which no suction has yet taken place, so that the material is first drawn by the auxiliary suction roller and spread on the surface of the main suction roller and the suction action of the latter is not interrupted by insufficiently covered places.

177916. Dr. HEINRICH WINTER, of Charlottenburg. *Process and apparatus for assisting the circulation in evaporating viscous fluids, more particularly sugar masse-cuite by means of large steam bubbles.* 22nd September, 1905. In this process the large steam bubbles are not introduced from the outside but are formed by means of collecting devices from the small steam bubbles resulting necessarily in the fluid at the heating places. The apparatus for carrying out this improved process consists of a plurality of collectors of a semi-conical pyramidal and, if desired, conically corrugated form, open above and at the sides and arranged in the liquid chamber and formed of parts, modifications or combinations of these forms, which are so arranged that they catch the small steam bubbles, compress them and so combine them into larger bubbles whilst the liquid may escape unimpededly at the sides.

177553. AUGUST GRÄNTZDÖRFFER, of Magdeburg. *An apparatus for introducing juice, water or carbonic acid into boiling or crystallizing vessels.* 4th April, 1905. In this apparatus a cone is inserted in the vessel which tapers conically at the bottom in such a way that between this inverted cone and the wall of the vessel a conical annular chamber is formed. A modification of this arrangement consists in the division of the annular chamber, which division is produced by means of radial walls into a plurality of separate compartments having separate feed.

NOTE.—Copies of all published specifications with their drawings in these lists can be obtained from W. P. Thompson & Co., 6, Lord Street, Liverpool, at One Shilling a copy for English or American Patents, and Two Shillings for German. In ordering please give number and date.

Patentees of Inventions connected with the production, manufacture and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

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IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

TO END OF JANUARY, 1906 AND 1907.

IMPORTS.

Raw Sugars.	Quantities. 1906. Cwts.	Quantities. 1907. Cwts.	Values. 1906. £	Values. 1907. £
Germany	853,870	1,003,201	357,648	455,429
Holland	6,753	21,350	2,658	8,609
Belgium	78,022	51,663	31,621	22,168
France	87,932	625	37,045	326
Austria-Hungary	62,820	107,850	25,835	48,946
Java	87,958	2	41,451	....
Philippine Islands	....	....	....	....
Cuba	41,500	....	16,008	....
Peru	107,041	59,961	49,476	26,945
Brazil	148,354	76,705	58,212	31,097
Argentine Republic	....	....	....	....
Mauritius	20,861	52,218	8,344	20,469
British East Indies	....	....	....	....
Straits Settlements	5,076	18,037	2,423	11,327
Br. W. Indies, Guiana, &c.	150,141	62,667	87,932	40,235
Other Countries	8,390	17,666	4,110	8,473
Total Raw Sugars	1,658,718	1,471,945	722,763	674,024
Refined Sugars.				
Germany	919,783	1,234,982	533,220	724,376
Holland	202,145	203,575	123,093	126,281
Belgium	26,063	19,705	15,516	12,134
France	269,072	48,677	150,036	28,973
Other Countries	72	13	90	7
Total Refined Sugars	1,417,135	1,506,952	821,955	891,771
Molasses	174,990	257,447	38,206	49,398
Total Imports	3,250,843	3,236,344	1,582,924	1,615,193

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	111	50	103	50
Norway	1,160	936	1,021	559
Denmark	4,116	8,528	2,127	4,436
Holland	7,880	6,969	4,575	4,492
Belgium	729	768	415	462
Portugal, Azores, &c.	2,978	2,343	1,698	1,371
Italy	4,858	1,794	2,616	980
Other Countries	51,239	23,350	32,662	16,760
	73,571	44,738	45,217	29,110
Foreign & Colonial Sugars				
Refined and Candy	1,122	647	816	514
Unrefined	10,329	3,068	5,228	1,642
Molasses	1,034	23	334	8
Total Exports	86,056	48,476	51,595	31,274

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to Feb. 14th ..	198,772	..	150,905
Receipts of Refined ,, ,, ...	160	..	100
Deliveries ,, ,, ...	192,652	..	175,408
Consumption (4 Ports, Exports deducted) since January 1st..	172,470	..	171,890
Importers' Stocks, February 13th ..	6,120	..	34,030
Total Stocks, February 20th	180,000	..	187,150
Stocks in Cuba, ,, ...	204,000	..	97,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1905-06 AND 1906-07.

(Tons of 2,240lbs.)	1905-06. Tons.		1906-07. Tons.
Exports	78,422	..	167,009
Stocks	59,118	..	165,365
	137,540	..	332,374
Local Consumption (one month)	3,960	..	4,100
	141,500	..	336,474
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 31st January.. ..	122,050	..	336,474

Havana, January 31st, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR ONE MONTH ENDING JANUARY 31ST.

SUGAR.	IMPORTS. 1905. Tons.		IMPORTS. 1906. Tons.		IMPORTS. 1907. Tons.	EXPORTS (Foreign). 1905. Tons.		EXPORTS (Foreign). 1906. Tons.		EXPORTS (Foreign). 1907. Tons.
Refined	63,718	..	70,857	..	75,347	84	..	56	..	32
Raw	59,345	..	82,936	..	73,597	189	..	516	..	153
Molasses	5,990	..	8,749	..	12,872	8	..	52	..	1
Total..........	129,053	..	162,542	..	161,816	281	..	624	..	186

	HOME CONSUMPTION. 1905. Tons.		1906. Tons.		1907. Tons.
Refined	62,594	..	66,803	..	73,070
Refined (in Bond) in the United Kingdom	45,396	..	47,721	..	43,228
Raw	8,977	..	12,872	..	9,952
Molasses	9,107	..	9,484	..	10,961
Molasses, manufactured (in Bond) in U.K.	4,809	..	5,660	..	5,824
Total..............................	130,883	..	142,540	..	143,035
Less Exports of British Refined....................	1,502	..	3,678	..	2,237
Total Home Consumption of Sugar	129,381	..	138,862	..	140,798

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, FEB. 1ST TO 16TH, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1907.
151	1314	786	819	260	3331

	1906.	1905.	1904.	1903.
Totals	3764 ..	2568 ..	3457 ..	3211

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING JANUARY 31ST, IN THOUSANDS OF TONS.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1836	1205	639	547	201	4429	3826	4206

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.	1903-1904. Tons.
Germany	2,250,000 ..	2,415,136 ..	1,598,164 ..	1,927,681
Austria	1,335,000 ..	1,509,870 ..	889,373 ..	1,167,959
France	755,000 ..	1,089,684 ..	622,422 ..	804,308
Russia	1,450,000 ..	968,000 ..	953,626 ..	1,206,907
Belgium	280,000 ..	328,770 ..	176,466 ..	209,811
Holland	190,000 ..	207,189 ..	136,551 ..	123,551
Other Countries .	440,000 ..	415,000 ..	332,098 ..	441,116
	6,700,000	6,933,649	4,708,758	5,881,333

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NOTES AND COMMENTS.

The Outlook.

As usual the Chancellor of the Exchequer has been careful to give no inkling of his intentions in the coming Budget, and one is still in the dark as to whether the sugar duty will be reduced or even abolished. As we have said before, our attitude towards it has been largely one of a neutral character. We recognise that the sugar users are hard hit; but we also know that there is no tax extant which does not severely affect some or other portion of the community. And since this tax was introduced tentatively as a means of broadening the basis of taxation, we thought it should be given a fair trial. If the sugar tax disappears, so does some of the revenue, and as the latter must be procured somehow, the taxpayer is not in the end given much relief.

As to the Brussels Convention, the Government have declined so far to express an opinion or to disclose their intentions. What the latter are, has in the main been surmised from the attitude of members of the Cabinet towards the measure when they were in Opposition. But one cannot always count on a Government giving effect to the individual and private views they held when out of office; it may prove more expedient to act otherwise. Thus the agitation against Chinese labour in the Transvaal may have been started in all sincerity; but, having got into power on the strength of a mandate

to abolish such labour, the Liberals have nevertheless found it expedient for various reasons to tolerate this status quo indefinitely. And, there are doubtless also grounds for supposing that this same Government when it comes to discuss the question of the renewal or denunciation of the Brussels Convention will have to consider other points of view than those they personally hold. As showing this, we may remark that the London correspondent of the *Köln. Zeitung*, in discussing this question, points out that while Germany may be indifferent to the result, France, on the other hand, is strongly opposed to any denunciation, and "under such circumstances the "English Government will scarcely care to put the friendship of "France to the test by denouncing the Convention. Any such "denunciation is therefore not to be expected in the near future." This quotation from the German paper is presumably not based on idle conjecture alone. It is quite conceivable that our French ally will have something to say in the matter, if she has not already said it. One only hopes that she will exert her influence to the utmost, and that such influence will not be lost on our Government. The bye-elections are already going against the Liberal party, and a few more reverses this summer may do much to steady their leaders' counsels.

British Beet Growing.

On another page will be found an article written by Mr. Sigmund Stein in his usual characteristic style on the prospects of the projected British beet sugar industry. Mr. Stein is right when he says that this must be started on a large scale or not at all. Scientific industries are now-a-days only carried on profitably when every possible source of waste is cut down to a minimum; and this can only be achieved by operations on a large scale. Consequently, the small establishment has no chance. As to Mr. Stein's opposition to a State subsidy to aid the new industry, he is, no doubt, from a fair trade standpoint, justified in taking such a view. But considering that tariff reform may ere long introduce a modified form of protection, there is something to be said for the plan of subsidizing the infant industry till it has at least got on its legs. Mr. Stein forgets that even if we have more favourable conditions in this country for growing beets, we are yet deficient in one respect, and that is in the experience gained by long years of work, which asset the continental growers and manufacturers possess and we do not. He also overlooks the fact the Germany's big industry was started with State aid. The granting of this aid was a wise step on the part of the German Government; the mistake, if any, lay in prolonging the bounty after the industry was established. As it is, we think it more than probable that if a beet sugar industry is started in this country, it will eventually be aided by a differential duty on sugar, such as

Canada enjoys. Foreign beet would pay more duty than British and colonial sugar. But much depends on the outcome of the negotiations with our colonies. If an Imperial bond of union is formed, well and good; but if "Little Englandism" wins the day and the Colonial overtures are rejected, it is impossible to forecaste the harm that may be done. In a few weeks more the delegates to the Colonial Conference will be in our midst; we trust they will inform the Government with no uncertain voice to what lengths they are prepared to go to obtain Imperial reciprocity. The next step will then rest with the Government, and we earnestly hope they will "think Imperially" too.

Cuba.

It appears that the figures we gave in our February number of the value of America's interests in Cuba were excessive, to judge from further information we have received. A correspondent of ours says that, as a matter of fact, the British interests are much larger than the American, but as most of the American ventures are watered to an enormous extent, on paper they appear predominating. As an instance, an estate in Cuba was purchased for £32,000, converted into an excellent sugar venture, and the property then sold for £1,000,000 in ordinary shares, besides £1,000,000 more in gold bonds to buy the necessary plant with; it will therefore be many years at present prices before they begin to pay a dividend of any kind except possibly out of capital.

The opinion thus expressed about British and American properties is rather confirmed by what the correspondent of the *American Sugar Industry* has lately told his readers. According to him, English capitalists have lately been entering the Cuban market, and snatching all the bargains they can. They have bought nearly all the railways in the island, and bid fair to get full control. The latest instance is that of the Havana Central Railway which could not be floated in New York; it was then offered in England and floated without any difficulty, and now the English people have obtained the control of the concern.

The same writer refers to the fact that the sugar estate, which Mr. Silveira started some time back and which was in danger of failure owing to the owner's disappearance, has lately been bought by some British capitalists, of which Messrs. Duncan Stewart & Co., of Glasgow, are said to be the prime movers. The new organization will be known as the Stewart Sugar Company. As Messrs. Stewart & Co. executed a large order for machinery for this estate, and were therefore creditors for a large sum, it is evident that they have done the best thing in trying to develop the estate. It is proposed to overhaul it, and to erect a mammoth Central having a capacity of 2,000 sacks a day. But, even though the estate covers an area of 15,000 acres, we question whether the capital (2½ million dollars) is not unduly large, especially

as there is, in addition, a bond issue of $2,750,000 which the Havana banks are to try and take up.

But one thing is absolutely certain. Cuba can and does produce her sugars cheaper than any other cane-growing country; moreover, cane left over from one crop to another is not lost cane as it is in the other West Indian islands; on the contrary, they very often get an increased yield due to the extra age. Thus, our correspondent claims to be cutting cane nearly two years old which has never been arrowed, and is giving him the equivalent of four tons to the acre, when last year it would have yielded little over two tons.

American Law.

The American Sugar Trust having lately succeeded in crushing a dangerous rival, is now being sued in the law courts by one of the victims for £6,000,000 damages. The latter charges the Trust with conspiracy. But lawsuits like this seem to be a regular feature of American courts, and generally fizzle out. Whether this case will have more hope for success remains to be seen; but as American law is in a notoriously inefficient condition, one is not over-sanguine that anything will come of it. It is a striking commentary on the difference between British and American methods of justice that whereas the Thaw trial has been going on for two months, and may last another two for all one knows, the trial in England of the murderer of another millionaire has only taken one day. The cases were very similar in character, but in England the time of the court was not, and could not have been, wasted in discussing the most irrelevant trivialities bearing on legal procedure. Hence the greater expedition. If Thaw was not insane when he committed the murder, one marvels if he is not insane now after all these weeks of suspense. In spite of their boasted superiority, Americans are yet much behind the older, and longer civilized, countries of Europe in their notions of justice and public morality. The recent revelations of Tammany rule in San Francisco simply out-Herod anything we have previously come across in the way of municipal corruption. One can understand now how the trouble with Japan arose, and we think all right-minded Americans will realize the folly of allowing a blackmailing municipality, which really consisted of but two men, to imperil the foreign relations of the whole Federal Union.

The Indian Crop, 1906-07.

The total area under sugar cane in the six provinces of British India for the 1906-07 season is given as 2,348,800 acres, an increase of 11·2% on the area of last year. The total output of sugar is estimated at 2,223,400 tons of unrefined sugar, an increase of 28·9%. The six provinces with their percentage of the crop are:—United Provinces,

49%; Bengal, 19%; Eastern Bengal and Assam, 11·2%; Panjab, 13·7%; Madras, 2·5%; North-West Frontier Province, 1%. On the whole the season appears to have been very favourable, and irrigation was sufficient, as the monsoon rains were timely, ample, and beneficial to the crop.

Fiji as a Field for Settlement.

Some particulars are given in a New Zealand contemporary of the prospects of Fiji as a field for settlement. Some of the land is reserved for native tenure, but the Government has recently acquired some 70,000 acres, and is prepared to sub-let them to settlers. Part of the area is in the wet and part in the dry zone. The former has an annual rainfall, it is said, of 12 ft. 6 in., while the latter has one of 6 ft. 8 in. The chief products of Fiji are naturally of a tropical character. Copra pays best, and sugar, which is chiefly bought by New Zealand, is Fiji's stand-by. But rubber, cotton, cattle and sheep rearing, are all possible, and the Government have taken a right step in founding two agricultural experiment stations. The temperature of the islands ranges between 70° and 80°, but the mortality is very low, and one regrets that British settlers should seem to prefer to go to South America rather than to stock British island colonies.

GERMANY.

The Sugar Production.

According to statistics published in the *Reichsanzeiger*, the quantity of raw sugar produced in Germany during the period from 1st September, 1906, to 28th February last, being the first six months of the 1906-7 sugar campaign, was 1,890,506 metric tons, as compared with 2,068,211 metric tons during the corresponding months of 1905-6. The quantity of refined sugar produced increased from 903,019 metric tons during the six months September, 1905, to February, 1906, to 947,761 metric tons during the six months September, 1906, to February, 1907.

The total quantity of beets used during the first half of the present campaign was 14,171,666 metric tons, as compared with 15,733,478 metric tons during the corresponding months of 1905-6.

The total output of sugar (raw and refined) during the period September, 1906, to February, 1907, expressed in terms of raw sugar, was 2,126,736 metric tons, as compared with 2,295,349 metric tons, the figure arrived at a year ago for the corresponding months of 1905-6.—(*Board of Trade Journal.*)

THE GOVERNMENTAL REGULATION OF THE RUSSIAN SUGAR INDUSTRY.

It is a popular fallacy that sugar obtaining a bounty is sold cheap. The only effect of bounties on the price of sugar is to create an abnormal increase in production and a corresponding decrease in the world's price. When that price has been forced, by excessive supply, below the cost of production, those producers who have a bounty can afford to go on selling, while those who have none must either cease to produce or lose money. No producer is so foolish as to sell below the market price—in fact, it is practically impossible; therefore it is quite a mistake to suppose that the British consumer sustains any loss by being unable to buy Russian sugar. If Russia produces sugar in excess of its consumption that excess helps, so far, to depress the market price of sugar throughout the world, and we get the benefit of that reduction of price whether we import Russian sugar or not.

In examining the Russian system, therefore, the only questions to be considered are how far recent modifications in it have resulted in preventing or checking the abnormal increase in production, and whether any further modification could be suggested with the same view. If the Russian production could be restrained within the reasonable limits of market requirements it would be quite competent for the Russian Government to ask for some reconsideration of the decision at Brussels with regard to Russian sugar.

The governmental regulation of the sugar industry in Russia, which began in 1895, was based on the principle of fixing a fancy price for home consumption and defining the share which each factory should enjoy in supplying that consumption. This system had one fatal defect. It stimulated each factory continually to increase its production in order to obtain a larger share in the home market supply. This resulted in a large excess of production over the requirements for home consumption and a consequent accumulation of unsold stocks which were, from time to time, thrown on the outside markets and helped, with other bounty-fed sugar, to depress the world's price to an abnormal extent.

It was pointed out at Brussels, in 1898, that if the Russian Government would fix for each factory a final estimate and limit of its production a check might be put to this excessive supply. The Russian Government, in 1903, when they found that their system had been condemned at the Conference, proceeded to apply this remedy. They fixed for each factory what they called its "normal production." If a factory produced more than that amount the injurious effect of the excessive production was made to fall only on that erring factory. Previously all the factories had suffered by any excessive production,

because all were deprived by it of a portion of their share in supplying the home consumption for the following year.

Another provision of the new law tended in the same direction. Instead of insisting that surplus production must be exported the Government gave the factory the alternative of carrying over its surplus to the following year, when it would be treated as part of its "normal production" for that year. The factory would, of course, if it wished to avoid a similar trouble, arrange its production so as to leave no further surplus over its "normal production."

These two provisions have undoubtedly checked the tendency to over-production. It was provided, in the original system of 1895, that a slight reduction should be made every year in the price fixed for home consumption. If the Government would increase and hasten that reduction, so as to be able to assure the parties to the Convention that a serious reduction in the excessive price of sugar for home consumption would be speedily established, there might be some hope of reconsidering the views entertained with regard to the Russian system.

It is satisfactory to know that in spite of the artificially high price of sugar in Russian markets the consumption of the country has gone on increasing at a rapid rate. Since 1895 the consumption has about doubled. The surplus quantity has largely decreased of late years, and the exports has been absorbed to a large extent by Finland and Persia, where prices above the world's price have been obtained. It is evident, therefore, that in any case we should not have received much Russian sugar in British markets.

The factories have made good profits out of the high home market price, and have succeeded so far, since the new law of 1903, in resisting the temptation to over-production. But it is a question whether they will be able to avoid that danger, in spite of the new safeguards which I have described. They continue to increase production in the hope that consumption will keep pace with it. If the Government would make a larger reduction in the fixed market price there might be some hope of its doing so. At present the fixed price, without duty, is more than 50 per cent. in excess of the world's price. A large reduction in this price might not really hurt the Russian producer, because he might be compensated for his lower price by a much greater demand. The Russian Government would be a large gainer by the reduction, because the larger consumption would bring with it a larger revenue from the duty. The producer should also remember, with regard to excessive production, that it can only result in ultimate loss, or rather in reducing the profit that he makes out of the home market, because the greater his surplus the lower will be its price in the world's markets.

George Martineau.

THE WEST INDIAN AGRICULTURAL CONFERENCE, 1907.

As our readers are aware, the 1907 West Indian Agricultural Conference was held at Kingston, Jamaica, on the 14th January last, in the presence of a very representative assembly. Since some account of the proceedings which were brought to a close in so tragic a manner will be of value to our readers, we have abridged the following from the excellent report furnished by the *Barbados Advocate*:—

In declaring the Conference open Sir Alexander Swettenham said he had great pleasure in welcoming to Jamaica the delegates and the influential, distinguished and numerous company Sir Alfred Jones had brought out. He was gratified to welcome people who carried so much weight in the Empire, and he hoped they would continue to come and visit Jamaica. Conferences of this kind, he declared, were amongst the agencies that made for the progress of the West Indies, and he hoped their deliberations would be fruitful of benefit to Jamaica.

Sir Daniel Morris then delivered his presidential address. He opened by extending a hearty welcome to the representatives. It was a source of great satisfaction to him that it had been possible to arrange for this conference to be held in Jamaica where he had spent some of the best years of his life, and in which he continued to take deep interest. Probably, in no part of the tropics could be found such diversified conditions as existed in Jamaica, and it was in consequence singularly favourable as a meeting place for those interested in agriculture. He referred gratefully to the thoughtful arrangements made by the Reception Committee, and to the proverbial hospitality of the Jamaica people, which had afforded the delegates from other places opportunities of becoming acquainted at first-hand with some of the island's industries, and he had no doubt the delegates would carry away with them many valuable hints to be used in improving the general agricultural conditions of the West Indies. He then proceeded to review the agricultural conditions of the colonies since the fifth Conference held in Trinidad in January, 1905, and declared that progress was being made in every direction. New industries were being added, and old industries were being developed. Mention was made of the erection of a central factory in Antigua at a cost of £43,000 capable of taking off 3000 tons of canes in 100 days; and the opinion was expressed that a similar factory would be beneficial to St. Kitts. Referring to the general anxiety felt throughout those colonies where sugar is the staple product as to whether the Brussels Sugar Convention was likely to be maintained, he announced that he had decided to appoint a committee consisting of representatives closely connected with the industry and to refer to them the preparation of a statement containing replies to the following questions:—

(1.) What has been the effect of the Convention in the West Indies?

(2.) What effect has the recent uncertainty as to its continuance had?

(3.) What would be the probable effect of its non-continuance?

By such means he believed it would be possible to place on record facts likely to be of value when the question of the continuance of the convention was under consideration in the mother country. At the same time attention was directed to the Canadian market. Canada had taken three-fourths of the sugar manufactured by the West Indies last year, and it was hoped that with the Dominion's rapid expansion it would take the whole of the West Indian output. Cocoa and citrus cultivation were next touched on, and the great advance Jamaica had made was shown by the fact that she now ranked third in the list of cocoa producing colonies. Coming to cotton, the President pointed with pride to the rapid progress the industry had made. There were now 18,000 acres in the West Indies under cotton cultivation and the export value of the industry was £200,000. The present season had so far been an unfavourable one. Pests had been more abundant, and the weather had been against the planters, but the prices had risen, and he hoped this would compensate cotton growers for shortage of their crops. One bale of Barbados cotton had just realised 2s. 4d. per lb. For his part he would prefer to have larger yields and prices at, say, 1s. 6d. per lb.

The mental attitude of the people towards agricultural education had also changed. It was no longer regarded as a fad of his. Local funds were now proposed to support the agricultural schools in several colonies, and in some places the boys had quite an appreciable sum in the Savings Banks as a result of the sale of the produce of their garden plots.

In connection with Agricultural Exhibitions the President emphasized the desirability of the colonies making arrangements to keep the special products of the West Indies prominently before the people of other countries. Exhibitions such as are periodically held in London, Liverpool and in Canada offered excellent means of making known these products at a small cost, and also of maintaining and extending trade relations. He went on to suggest that sums ranging from £20 to £100 a year, according to local circumstances, should be placed annually on the estimates so that the Permanent Exhibition Committees would be able to get together and ship trade samples. Money thus expended, it was declared, would be a sound investment and entirely beneficial to the West Indies.

The Archbishop of the West Indies then moved a vote of thanks to the President for his address, which was seconded by the Hon. Howell Jones. The latter said he thought he would create not a single feeling of envy if he mentioned the name of Mr. John R. Bovell,

whom they all regarded as one of the Commissioner's main supports.

Sir Daniel Morris, in acknowledging the vote of thanks, declared he was glad reference had been made to Mr. Bovell, and he would also mention Dr. Francis Watts and his other assistants. He urged them to assist and to encourage those men in the valuable work they were doing. When he was first asked by Mr. Chamberlain to accept the duties of Commissioner of the Department of Agriculture he was not quite sure that he had the physical energy necessary for the task set before him. But he had always had men around him who had given him their loyal and thorough support, and he had also had the support of the Agricultural Societies and the leading planters in the several colonies. Now that attention was being drawn to the circumstances of these possessions he was certain they would receive larger support and sympathy from all interested in the welfare of the West Indies.

Subsequently Mr. H. H. Cousins read a paper on the sugar seedlings in Jamaica. He stated that D 95 had been found very suitable for light soils where there was irrigation. B 147 had not given the results expected from it, but in Trelawny where they were subject to droughts, it had proved a valuable drought-resisting cane. B 208 had given excellent results, and planters were much pleased with it.

Dr. Watts read a paper on the results of recent experiments with seedling and other canes in the Leeward Islands. The introduction of varieties, he said, was consequent on the disease attacking the Bourbon so that the crop fell from an average of 17,000 tons to 7,500. Other varieties than Bourbon were planted now, and diseases caused no anxiety, which he somewhat regretted, as, unless there was watchfulness, disease might come upon them unawares. The interest in the varieties now gravitated towards the production of the richest sugar yielding plant. The new varieties had, in a general way, been completely substituted for the Bourbon in the Leeward Islands. But there were still 190 acres planted in Bourbon out of a total 9,000 acres. White Transparent was regarded as a new variety when first introduced, but in a few years that too would give place to other varieties. In St. Kitts the value of the industry was over £120,000 a year, and but for the varieties the industry would have been extinguished.

In reply to a question Dr. Watts stated that in no instance had the Bourbon been brought to maturity in St. Kitts since the disease had attacked it.

Asked whether some seedlings were not also subject to disease Dr. Watts replied in the affirmative, but pointed out that those which proved unsatisfactory could easily be discarded.

Mr. O'Neale asked if there was any decrease in the cane crop planted after cotton.

Dr. Watts said, on the contrary, there was an increase.

The President said it had recently been stated in the *Agricultural News* that no apparent difference was noticed as a result, but an increased amount of manure was necessary. In St. Kitts they were quite satisfied they could grow cotton as a rotation crop.

In reply to Mr. Howell Jones, Dr. Watts said the substitution of new canes should never be made on a wholesale scale until they were satisfied that the variety was immune from disease. The changes were to be carried on cautiously and not suddenly, or in a violent and drastic way. The extension of varieties should be entered on not in a spasmodic effort as the result of a panic, but as an integral part of a planter's work.

Mr. Bovell mentioned that three seedlings had remained free from disease over several years now.

Mr. Bovell next read a paper on experiments with seedlings in Barbados. The first experiments in seedling production in the Empire were started in Barbados in 1888, and the experiments had been continued and brought up to date in 1905. The experiments comprised manurial tests and raising new seedlings; also the increase of saccharose in seedlings. So far they were dealing with 6759 new seedlings, and 95 of these were considered good enough to recommend to the planters. Whilst Mr. Bovell was reading his paper the earthquake occurred, and the proceedings were brought to an abrupt close by that tragic event.

The Conference was resumed on board the "Port Kingston" a few days later, whilst on the way to Barbados. All the delegates from the other colonies and Sir Alfred Jones and the honorary members among his party were present.

Mr. J. R. Bovell gave a *resumé* of the position of the cotton industry in Barbados. The industry, he said, had proved remunerative, and had extended rapidly. In a few years it had grown from 16 acres to 5,000 acres. The increase was well illustrated at Stirling plantation. In 1904 the owner had planted 34 acres, in 1905 he had put in 56 acres and in 1906, 90 acres.

Mr. F. J. Clarke referred to the formation of the Cotton Company to buy cotton from growers, and explained the methods adopted to secure careful and clean picking by the labourers in the fields. The present crop at Barbados had proved a failure in part. The bolls had fallen in the dry weather, and the heavy rains had caused mildew. Diseases had appeared; but he thought if all the planters had been alive to the necessity of treatment at once they would have kept the worms under. The Paris green had been washed off by the rains, and this discouraged many people from using it as freely as they may otherwise have done. Those were discouraging conditions, but, on the other hand, prices had risen.

Mr. G. Carrington said he used to plant cotton sixteen years ago, and his plan was for it to come into bearing in February. He still thought this was what should be aimed at. November and December were the wet months in Barbados, and he did not think they should bring their cotton forward to be picked in those months. The best fields now growing in the island had been planted in October.

The President observed that no hard and fast lines had been laid down by the Department. They might adopt early or late planting as suited to local circumstances. They were still experimenting. October was a late month. Of course, if they had regular seasons the matter would be more easily dealt with. The object to be kept in view, was, as far as possible, to adopt cotton as a rotation crop on sugar estates.

Sir Alfred Jones enquired if the cotton growers in Barbados required advances to enable them to carry on cultivation.

Mr. Clarke explained the working of the Plantations in Aid Act, by which the £80,000 granted to Barbados to aid in tiding over the period until the Brussels Convention came into force, was used for financing estates generally. The Commissioners working this grant had not made a single bad debt since the Act was passed.

Mr. Pearson thought the grant had been made purely to aid in sugar cultivation.

Mr. Jesse Collings said he remembered the debate perfectly, and the grant was asked for and made for the general regeneration of the islands rather than for any specific industry.

Mr. Clarke said it was not as if they had a lot of new men coming in and taking up the land to establish a new industry and oust sugar cane cultivation. The same planters were going on as before. Cotton, moreover, was a subsidiary industry, and they aimed at making it a rotation crop.

Mr. Jesse Collings considered Mr. Clarke's explanation perfectly sound; and Sir Thomas Hughes and Mr. Henniker Heaton agreed.

Dr. Watts gave a summary of the results of cotton growing in the Leeward Islands. The report was favourable on the whole, although the seasons this year had been against the planters. He mentioned that in some of the smaller islands, especially in Anguilla, the introduction of cotton growing had changed the habits of the people, and instead of subsisting on root crops and raising a little stock they were building up a regular industry and an export trade.

Sir Daniel Morris, dealing with the cotton industry in St. Vincent, said that Island had suffered badly by the hurricane of 1898, and it had been further thrown back by the eruption of 1902. Soon after, the cotton industry was started there, and in 1902-3 they exported 474 lbs. cotton. In 1904-5 they exported six times as much, and in 1906-7 they had exported 8,000 lbs. The area in 1904 in cotton was

1,500 acres, but in 1905 it fell back to 800 acres. But as he had mentioned, they had as a result of better cultivation a larger return from the smaller area. In 1906-7 the area went up again to 1500 acres, and the prices that year were the best obtained, viz., eighteen-pence. They had had excessive rains this season and the yield of lint was low in consequence. As regards the small cultivators in the several colonies, the President went on to explain that whilst an endeavour was being made to instruct them in cotton growing, they were not advised to go in for the industry on any scale, as if they had a couple of bad seasons it would mean ruin to them, whilst the plantation owner would be better able to bear a loss. There was fear of repeating the lesson taught by the hurricane in Jamaica in 1903. Every small owner had put his land in bananas, and when the hurricane came his loss was total and complete, and he had no other crops to fall back on. Hence they did not encourage the small owner to go in for cotton before he fully and clearly understood the risk he was running. They sought to begin at the top and teach the big landowner first. In that way the knowledge would be more quickly acquired and more generally spread. At the same time they did not discourage the small man. In Nevis, for instance, he found the other day that some 350 small growers had put in cotton, and there was great risk of their losing their crop through lack of knowledge. He at once telegraphed for an expert to enable them to save their crops, and this had been successful.

Sir Alfred Jones said he was very pleased with the statement that had been made, and especially with Mr. Clarke's explanation of the financial situation in Barbados. He thought that much was due to Mr. Chamberlain for that satisfactory state of affairs. He was certain that if the West Indies would only grasp the fact, they had the means of great prosperity before them. They would grow cotton and they could make money out of it. There was no possible doubt about that. As regards the company formed on the voyage out to work one of Lord Dudley's estates in Portland, operations would be begun at once, and would be pushed on. As regards the present expedition he intended, all being well, to bring out a far greater expedition next year. He was not going to give up the West Indies.

After some further remarks by the President the Conference closed.

An interesting type of cane crushing mill is one made by the Mirrlees Watson Co., Ltd., of Glasgow, specially designed in sections for easy transport on muleback across mountainous countries. There are about 40 parts, not counting keys or bolts, and the heaviest does not exceed 270 lbs. or 123 kilos; and the capacity is 1500 to 2000 lbs. (680 to 910 kilos) of cane crushed per hour. This type of mill might come in handy in Peru, where transport over the Andes is still a difficult matter.

FUNGI AND FLIES IN HAWAII.

Some voluminous notes are given by Mr. N. A. Cobb in one of the most recent Bulletins issued by the Hawaiian Planters' Experiment Station on the fungus *Ithyphallus* and its influence on root disease of the sugar cane. These notes and the accompanying illustrations take up some 80 or 90 pages. Not the least interesting information is that which shows how common flies are capable of spreading fungus spores far and wide; and the details of the flies themselves are well worth a careful study.

The *Ithyphallus* belongs to the group of fungi called Basidiomycetes, a large group which includes the mushrooms or toadstools, and the puff-balls,—in fact these two constitute, roughly speaking, the two great divisions of the group. Mushrooms grow for a long time underground, but finally issue from the ground and grow for a time above the surface. It is from this aerial part that the spores or seed are spread abroad so as to aid in perpetuating the species. In puff-balls this tendency to lead a hidden life and finally to produce an evanescent spore-bearing part is intensified, so that in some cases the aerial part has so brief a life as often to escape notice, even in the case of common species. These characteristics are also present in the *Ithyphallus*, for it passes so small a portion of its life above ground that it may almost be classed as a subterranean species. Important as is this eruption to the fungus, the time within which it takes place is exceedingly short—only a few hours.

The early stages of the *Ithyphallus* are not yet fully studied, but at what is called the strand-producing stage, it has been noted that the sporophores first appear as small spherical or ellipsoidal growths. These at first consist of mycelium alone, compactly woven together but containing some air. In subsequent development a head forms, so that the whole then consists of a stipe, and a head or gleba as it is called. The peridium or outer covering is a capsule of gelatine, held in position by two membranes. As to the time required for development, observations made over a period of 18 months suggest that under favourable conditions the process may be completed inside of one year, but two years is nearer the average. The final stage, the aerial fructification, is a striking object; its red colour, its peculiar form, and its penetrating odour all tend to give it prominence. In Europe it is known as a *Stinkhorn*, owing to its odour and to its peculiar horned shape. Mr. Cobb proposes accordingly to call the Hawaiian species the Coral Stink-Horn (*Ithyphallus coralloides*).

A special study of the final stages of fructification was made at night. It was found that the first decisive movements took place about 3 a.m., and that the fungus stalk finally erected itself at or near sunrise. In general all the peridia that are destined to come forth on that date may be seen to rise very slowly, until at daylight they have

risen one to two millimetres. A struggle is clearly going on within, and at last the outer skin cracks and gives way along a more or less irregular circular track 3 to 4 mm. in diameter. This circular patch so formed remains to the last as a sort of cap on the top of the sporophore. After the rupture of the outer skin the development of the stalk proceeds more rapidly for from ten minutes to half-an-hour. During this time the sporophore slowly emerges from the top of the ruptured capsule, restrained only by the thin and tightly stretched skin immediately covering the spores. When the bottom of the sporophore has passed the constriction represented by the first circular break the skin at last ruptures, whereupon the elastic compressed pedicle released from all restraint increases rapidly in height, so that sometimes in so short a space of time as one minute it has "grown" to the height of several inches. A particular specimen which was barely a quarter of an inch out of the ground at 3 a.m. had increased to $\frac{5}{8}$ of an inch by 3-30, at 6-30 $1\frac{1}{4}$ inches was visible, and at 6-44, when the skin covering the spores ruptured, the growth was over $1\frac{1}{2}$ inches high. A minute later the height had been increased to three inches, or just doubled. We regret we are unable to reproduce here the remarkably graphic illustrations of this "fungus-popping," which are to be found in the *Bulletin* from which this account is taken.

For a few hours these fructifications stand quite erect and even display a certain amount of stiffness, so that they can resist a small degree of pressure. Early in the forenoon they begin to wilt, and not long afterwards they lop over and shrivel up. Meanwhile, however, flies have visited the sporophores to good purpose, not infrequently cleaning them so completely of their spores that they look as if they had been carefully washed with a soft brush. The flies secure a favourite food, and along with it swallow the spores, and carry them away to be distributed with their excreta. It is interesting to note that many of the facts in the growth of this fungus are only explicable when we are aware of its reliance on insects for the distribution of its spores. Then we see why the spores are developed in smaller numbers than in many of the related fungi. Their distribution is being accurately provided for, and hence there is no need to allow for waste, such as occurs when the distribution of spores is left to chance. We see why in the subterranean darkness a brilliant pigment is elaborated. It is so that no time need be lost by insects in finding the feast that is to be spread in the upper air for their delectation. And we realize that the odoriferous scent is after all only to widely advertise the feast as soon as spread.

Having described the *Ithyphallus*, we may now give some attention to the study of its ramifications, and in particular of its influence on the root diseases of sugar cane. Although time alone can show what is the relative importance of this fungus among such root diseases, yet it seems evident that its evil influence is extensive and widespread.

As a measure of the extent to which losses due to root disease may occur, it will suffice to quote some figures resulting from an accurate inspection of the important sugar-growing districts of Hawaii. Seldom less than 8 to 10% loss in the fields was noted, and quite frequently the failures amounted to 25%, and in a few cases rose as high as 50 or even 60%. A conservative estimate of the losses would be 10% of the ratoon crop and a somewhat smaller figure for the plant crops. These losses were all in the main due to root disease.

Naturally such losses are considered a serious tax on the cane industry. Indeed, in Mr. Cobb's opinion, there is no other single pest existing in the cane fields that can compare with it in seriousness. Field examinations reveal as the most serious loss the smothering of the new shoots of ratoon stools. When one sees the efforts of the plant to produce new shoots time after time defeated by its enemy, observes the weak and tardy character of the shoots that do succeed in getting above ground, and notes the number of absolute failures in ratooning, he will realize what losses his fields are sustaining through the attacks of this root disease.

It was in 1905 that suspicions of the presence of *Ithyphallus* were sufficiently confirmed as to warrant careful observations being made. But at first all attempts to secure fructification from the infected cane roots, trash, or stubble failed. Methods found successful when dealing with root disease in other countries were of no avail. Consequently a fungus of distinct species was suspected, and a systematic search for it in the soil round the canes was instituted. In the end this search was amply rewarded by the discovery in a Hamakua plantation (where the soil was notably porous and friable) of a complete collection of *Ithyphallus* in all its fruiting stages.

The particular field had been ratooning badly, the failure of sundry ratoon stools being very marked, at least 60 % of them being affected. The cane was *Rose Bamboo*, and it was suffering so severely that its abandonment had been decided on. So thoroughly was the land infested that even replant cuttings sometimes became partial if not complete failures. Soon after the small immature fruits of the root disease fungus were discovered, there were unearthed near by some peridia 15 mm. in diameter, those previously met with only having been 1 or 2 mm. Shortly afterwards one of the men hoeing the field came upon a cluster or nest, amongst which was one that was about to burst and appear above the surface of the ground. Then the dried up remains of other fructifications were found on the surface of the ground. In consequence some men were told off to search in the early morning at a time when the final process of emerging from the ground might be expected. The result was a collection of abundant data in the form of photographs, sketches, and notes, to be found reproduced in the bulletin under review.

The first point was to establish beyond doubt the connection of the fungus with diseased cane plants, and this was satisfactorily achieved. Wherever it was possible to completely trace the strands of the *Ithyphallus*, it was found that they were connected with the bases of diseased stools, or with a cutting that had been planted, or with loose pieces of cane trash remaining over from former crops—and with practically nothing else.

"The distance of the fructifications from the base of the diseased stools varied from one or two inches to eight or ten inches, and it was noted that the location of most of them was on the shady side of the cane plant or its remains. On digging downward at the base of the fungus one soon came to the capsule from which it had sprung. The principal strand at the base of this capsule usually came from the direction of the nearest diseased cane stool or stubble. Sometimes branches from it, branches of considerable size, were connected with old pieces of cane lying loose in the soil, but more commonly the whole system of strands was connected intimately with the base and root system of one diseased stool. It sometimes happened that the stool was one that had made more than average growth, considering the nature of the whole field. In no case, however, could the stools be called healthy, and in the great majority of cases they were badly smitten."

It is to be noted that the capsule, which has remained nearly spherical, changes its form just before fructification; and becomes more elongated, while its upper end becomes more pointed. As the final stages approach, the colour of the fungus, which has been hitherto white or pinkish, changes to a slightly more ruddy hue.

The mycelium constituting the free food-gathering organs of the fungus presents the characteristic clamp joints. One of the objects of the free mycelium appears to be to find some wound in the surface of the part of the cane plant attacked. And as it certainly possesses the power to penetrate the walls of internal cells, it can possibly do the same to the walls of the outer cells. The outside of young underground buds, suckers, or roots is the most likely place for such an occurrence.

A wound in the cane is easily entered by the mycelium of the *Ithyphallus*, and from this entrance it spreads into the interior of the cane plant. Its usual method appears to be to follow the vascular bundles and proceed from the cells of the bundles to the surrounding parenchyma. As a result of this entrance of the fungus into the healthy tissues of the cane, the vascular bundles often take on a reddish to dark-brown colour.

The entire history of the fructification of this fungus points to culmination in the germination of the spores after they have passed through the digestive canal of a fly or some other insect, so that it is not surprising to find that the next step taken by the experimenters

in Hawaii has been to study the habits and movements of the flies themselves. And very interesting the data prove to be. In the relations of insects to *Ithyphallus* we have one of those peculiar adaptations between plants and insects by which each is a gainer. The fungus evidently lays itself out to attract insects, which in turn serve it by distributing its spores in a highly efficient manner. As to the manner in which this is accomplished, the spores do undoubtedly stick in large numbers to the feet of the flies, but it seems evident that the largest number are swallowed by the insects and then passed out with their excreta. It is known that some seeds and spores only germinate successfully after they have passed through the intestines of animals or birds; and probably a similar state of affairs prevails in the insect world. That the majority of the spores are distributed *via* the excreta is suggested by the following points:—The number of spores taken away on the feet would be comparatively insignificant. Though it amounted to hundreds of thousands, yet the number ingested would reach hundreds of millions per meal. Then flies are notoriously clean in their toilet and the spores would not remain long on their feet, whereas the ingested spores might take six hours to all pass off in the excreta. In studying the habits of flies, it has become evident that the three most important factors in the distribution of the Hawaiian species of *Ithyphallus* are the vitality of the spores, the food habits of the flies, and their power of flight and other means of locomotion.

As to the spore vitality, germination experiments have shown that this vitality is preserved for several months even after the spores have passed through the intestines of flies. And it is interesting to note that the number of spores borne by a single head of *Ithyphallus* varies from six to ten thousand million, according to careful calculations made.

The digestive powers of flies vary, even the same species showing remarkable variations. One fly is found to be a gourmand, while another is comparatively abstemious. One may be costive in habit, another quite the opposite. The fæces may be liquid in one individual, and quite solid in another of the same species.

Experiments show that the fly's crop is more in the nature of a storage sack than a true digestive organ; and the time occupied by digestion is correspondingly short. Ten minutes to half an hour is about the minimum period, and has been ascertained by feeding a captive fly with food coloured with black so as to similarly colour the excreta; defecation however continued for at least three hours. This frequency of defecation is remarkable. As an example, a Sarcophagous fly was fed on *Ithyphallus* spores, of which she ate heartily. Twelve minutes afterwards she passed liquid excreta with comparatively few spores. From that time onwards, at intervals of about one to fifteen minutes, and averaging about five, she passed

material containing increasing numbers of spores until at the end the fæces were almost a solid mass of spores. This continued for six hours, when the number of spores gradually decreased; but during those six hours the number of defecations that contained spores was about thirty. Out of doors this would have been a remarkably good dissemination. A fly may thus in the course of a single day by defecation alone deposit the spores of *Ithyphallus* in no less than fifty different places.

To find how many spores were contained in the fly "specks" or excreta, five of them were distributed in ten cubic centimetres of water, and by counting the spores in an aliquot part of the water, it was calculated that each "speck" contained on the average over 22 million spores.

A fly of the blue green type, fond of *Ithyphallus*, was found to weigh 70 milligrams. When hungry she ate 32½ mgr. of spore food, or practically one-half her own weight. The meal occupied only a minute or two. Another blue fly weighing 55 mgr. ate 17½ mgr. of syrup at one meal lasting 40 seconds. It is therefore correct to assume that a hungry fly eats from one-fourth to one-third of its weight at a meal if it can get it. And it seems quite safe to say that each fly eats about its own weight of food per day, if not more.

Some interesting experiments were also undertaken to show the great powers of flight possessed by some flies due to the enormously powerful wing muscles they possess, and chronograph records were taken of the frequency of beats of the wings of such flies. One specimen of *Syrphus* that had been in captivity 24 hours gave as the average of four tests the incredible number of 400 wing vibrations per second. A second specimen gave 378 as the average of five tests, while flies of other species varied from 199 to 282. The first two numbers quoted are however open to question as being subsidiary vibrations. Still averages of 230 to 250 are remarkably high, and these were definitely established as the result of numerous tests. It may be added that a tuning fork gave, for pitch A international, an average of 443 vibrations.

REMEDIES.

Having described at some length the *Ithyphallus Coralloides* and its distributing agents, it is now pertinent to consider what remedies are available for the reduction, if not total suppression, of this pest.

A number of remedial measures, all resting on a basis of ascertained fact, are suggested by Mr. N. A. Cobb. Some of them involve considerable expense while others are cheaply undertaken, but, having regard to the ultimate gain, it is probably the best plan to adopt these measures as a whole, and not to rely on one or a few of them; this will be found in the end the most economical way.

The first remedy suggested is the use of lime as a fungicide. The use of lime on sugar lands in Hawaii, at the rate of 800 to 2000 lbs.

per acre, has recently been on the increase. The usual method of application is to take the lime in barrels, and empty their contents in piles on the land, and to cover these piles with earth till the lime has slaked at least partially. This reduces the lime to a powder, and facilitates its spreading. The application of the lime takes place after the ploughing out of the ratoon crop. This practice was originally conceived as a means of manuring the land; but it is doubtful whether its effects have lain in its action on the soil above. Rather is it to be suspected that the effect of the lime on the living enemies of the cane has had something to do with the subsequent improvement of the crops. Instead of applying lime to the fields more or less fully slaked, Mr. Cobb recommends that it be applied as nearly unslaked as possible and in the maximum quantity the land will stand up to at least one and a half tons per acre; apply it along the old stubble before ploughing, and let it remain a few days to sink in. If rain follows, it will put the finishing touch to the process, for the more soaking the better, and the stubble, which is sure to be the retreat of all the insect and fungus pests, will be thoroughly disinfected.

The ideal application is to give each stool of stubble its proportional dose. One ton of lime per acre means about half a pound per stool. The application should be made just after the field is burned over, so as to give the lime as much time as possible in which to work.

Naturally, another safe remedy is to promptly destroy the *Ithyphallus* spores as far as they can be discovered. These generally congregate on the shady side of the stools, and it is worth noting that a few days' rain will bring them up in large numbers. Consequently, if the labourers working in the fields in the early morning are instructed to look out for the fungus and uproot it, much good will be done. The fructifications should in any case be burned; stamping on them or burying them will be useless.

Further precautions to be taken are the keeping away of old trash from contact with the cuttings when planting, so as to avoid infection. It is also advisable to open up infested stools and expose the fungus to the withering effects of light and air. Finally, the number of flies should be kept down. But though this is a sure piece of advice, yet even Mr. Cobb cannot yet suggest a practical way of carrying it out, and indirect methods, such as depriving the flies as much as possible of likely food, *e.g.*, carrion, exposed manure, &c., seem to be the only ones available at present.

To sum up:—

1. Root disease is one of the worst pests now present in Hawaiian cane fields, the losses caused by it being of a serious nature.

2. The Basidiomycetous nature of the fungi causing the disease has been established, and the species *Marasmius sacchari* and that provisionally named *Ithyphallus coralloides* are responsible for some, perhaps most, of the damage.

3. *Ithyphallus coralloides*, probably an immigrant from the Australasian region, is now proved to have parasitic characters. It is closely related to *Ithyphallus aurantiacus* (Montagne), Ed. Fischer, a species originally described from Australia, but now known in other parts of the world. Whether the two species are identical can only be determined by a further examination of the Australian species.

4. Flies play a very important part in the distribution of this fungus. They feed upon the spore masses, and as the spores, in hundreds of millions, pass through the flies uninjured, they are disseminated widely and rapidly.

5. The spores of *Ithyphallus coralloides* on germinating at once produce secondary spores. The further history of these spores remains unknown.

6. The voracity and omnivorousness of flies, together with their comparatively enormous wing powers, make them formidable instruments in the spread of *Ithyphallus* and other disease-producing organisms, including those infesting men and animals, as well as plants.

7. Root disease can be effectively fought by the use of cultural methods; the proper selection, inspection, and disinfection of cuttings; the use of resistant varieties; the destruction of *Ithyphallus* fructifications; and the suppression of flies.

ENGLISH BEET SUGAR.

By Sigmund Stein, Sugar Expert, Liverpool.

There is so much talk, writing and debating going on at the present moment regarding the question of establishing beet sugar factories in the United Kingdom that it can fairly be said, that "sugar beet" and "English beet sugar factories" are the topics of the day in agricultural circles.

I am constrained to admit this from the number of letters on this question I receive by nearly every post. People of whom I have never heard nor have seen, and from all parts of the country, write to me for information, or send samples of beetroots for analysis. These people think I have to comply, as they presume I am in the service of the Government or of the country and am bound to answer and to give information. In this matter they are mistaken. I am neither in the service of the Government nor in that of any public body. The propaganda for establishing a home sugar industry which I have carried on for so many years is one entirely at my own expense. I have already sacrificed in this cause a large amount of money, a great deal of time, and much hard work.

I have issued over 100 different publications on the beet sugar question in form of booklets, pamphlets, leaflets, instructions, &c. I

have also given lectures on the same subject in most counties in the United Kingdom.

Further, I have instructed the British farmers how to grow beet, by giving them free of charge for a number of years sugar beet seed, and manure for experimental purposes. I analysed the sugar beet free of charge and sent for a great number of years my Certificate of Analysis and Report to each of the experimenting farmers. In this way I conducted over 3,000 experiments in beet growing, covering practically every county in England, Scotland, and Ireland.

I am not the originator of the home beet sugar problem, as sugar beets have been grown experimentally as far back as 60 or 70 years ago. What I have done has been to give general instruction to such farmers as were interested in the subject. And I have practically done at my own expense in this country what foreign Governments generally do through their state-aided experimental stations.

The Present Propaganda.

Most of the Chambers of Agriculture, the Farmers' Unions and Societies, as well as County and Town Councils, have taken the matter up lately and discussed it fully at their regular meetings. I have in many instances been able to assist them by giving them information or advice. I am however very sorry to see how certain people view the matter. I find that certain persons have been making use of the data to be found in my various pamphlets and have appropriated these without any acknowledgment as to the source; furthermore, they have gone to the length of republishing them as being of their own composition. These gentlemen, who have never managed a beet sugar factory, and whose whole enterprise consists in the use of scissors and paste and the study of other people's papers, have no practical knowledge.

These new "advocates" for a home sugar industry, in writing on this question, want the British Government to give to the home sugar manufacturer a bounty of £4 per ton of manufactured sugar.

This means that the smallest factory which could be profitably erected in this country would receive a Government grant or bounty of £16,000 on the production of 4,000 tons sugar.

The absurdity of this idea will immediately be seen if one considers that we would require 400 such factories to cover our demand for sugar, and that these factories would require a Government grant of £6,400,000 per annum. For 40 years a war has been waged against the Continental bounties; barrels of ink and truckloads of paper have been used up in fighting the bounty incubus; and now these ingenious men come forward as saviours of British agriculture, asking British taxpayers to open their pockets and throw money into the new beet sugar factories.

What Government would do it? The British public certainly would not stand it. I am myself too much of a fair trader, and can

see the impossibility of such a measure. If one helps one industry, why not help and support a dozen others.

England, being known as the home of the greatest political economists, will certainly not grant a measure which is opposed to all dictates of common sense.

The friends and enemies of an English beet sugar scheme change their views as easily as the English weather changes.

Here are several instances :—

(1.) A gentleman having an old mill at his disposal wrote to me to come and see it and give my opinion of its suitability for a beet sugar factory. I come, and find that none of the five principal conditions for a factory site are complied with. I give a most unfavourable report. Immediately this gentleman turns a dead enemy against English beet sugar.

(2.) A professional company promoter hearing that his services cannot be of any use for a British sugar factory becomes an antagonist.

(3.) Several gentlemen scrape together a few thousand pounds, and want to start a sugar factory *on a small scale*. Hearing from me the impossibility of such a scheme they forthwith become "dead" against British sugar.

(4.) A gentleman desiring to achieve popularity in a Town or County Council takes up the sugar beet question. He wants not only moral but also financial support for the scheme from the public bodies. The latter refuse, and our friend turns a bitter enemy.

(5.) The friends of the West Indies, and other interested parties, fear the ruin of those colonies if we manufacture our own beet sugar, forgetting that we take only a small quantity (cane sugar) from the Colonies, and that the bulk of our supply comes from Germany, Austria, France, and Holland.

(6.) Many people interested in the present state of imports of *foreign manufactured* sugar do everything possible to prevent the creation of a home sugar industry.

(7.) The lamentable failure of the Lavenham factory gives many people cause enough to think that as 34 years ago this unfortunate factory had many reasons for closing its doors, a modern, well managed factory would needs meet the same fate.

I must mention the great harm many supposed friends of the beet scheme are doing. They ask questions in Parliament or write to the papers. The way in which they are working will not tend to bring about the creation of factories. The thing must be considered from a different standpoint, which is :—

> Either the English beet sugar factories can be erected and conducted without state aid or they cannot. In the first instance no support is necessary. In the second instance, if an industry cannot stand on its own legs better leave it alone.

In these days of progress and under present conditions of science and commerce, it is utterly impossible to create and build up a new industry simply and solely as one would rear a hothouse plant.

Supposing the advocates of a state bounty for the British sugar industry were to succeed in receiving a grant from the Government for a number of years, then what would become of these factories later on when the Government grant and state aid ceased? The question is not difficult to answer.

That is not the way to create an industry.

Three years ago one of the greatest continental sugar manufacturers told me at a meeting: "If you succeed in receiving a grant from the English Government, I am willing to come over at once and erect beet sugar factories in England solely with the object of receiving the financial grant."

Several American and continental firms questioned me lately regarding the erection of factories. It is only to-day that I received the following letter from one of the best known sugar magnates of the United States. The letter is dated 5th March, 1907, and in it the gentleman writes to me: "I thank you for the 12th Report of your sugar beet growing experiments in the United Kingdom, which you kindly mailed me. I note with much interest the reason set forth for the apathy shown by capitalists in England concerning the beet sugar industry, and trust that the day will come when it will be removed. I can hardly conceive of any civilized nation continuing for all time to import this largely used article of diet when the economic advantages of producing it at home are so great. It would seem to me that the time must eventually come when all temperate zone countries will produce the sugar they consume, and thus compel the tropics to devote themselves to other lines of industry. I can imagine how you feel after spending such a large amount of time and money in preliminary experiments and meeting with such excellent results." Here you have the mature views of one of the world's greatest sugar manufacturers.

When the sugar bounties had been abolished, one of the leading men in the English sugar trade wrote to me: "Now is the time when you and your farmer friends should start the so-long-talked-of beet sugar industry."

Advantages of a British Beet Sugar Industry over Continental ones.

(1.) We can grow more beetroots per acre.

(2.) We can grow much richer roots than on the Continent.

(3.) We have the consumption at hand, being the greatest sugar consumers in the world.

(4.) We save freight.

(5.) We save commission, as the factory sells direct to the consumer.

(6.) We can make use in the new installation of the latest improvements in cultivation and manufacture by having at our disposal the latest implements and machinery.

(7.) We can manufacture in the prospective sugar works refined sugar direct from the beets at a very low price.

(8.) We can employ the plant of our works in the summer months after the campaign is over much better than the factories can do on the Continent, as we have many other industries in this country which could be well carried on in this factory.

(9.) Our coal is better and very much cheaper.

(10.) Coke and limestone are cheaper and nearer at hand in England.

Considering all the advantages we have here, I do not know of any reason why an English beet sugar factory, if properly, scientifically, and economically managed, should not work with great success.

The English Sugar Tax.

Since 1901 we have been saddled with a sugar tax amounting to 4s. 2d per cwt. of refined sugar. This sugar tax, imposed as a war tax, was intended as a temporary measure, therefore its continuance is opposed to all the promises made at the time of its creation.* It should be abolished as soon as possible. The opportunity comes now when the coffers of the Treasury are filled to such an excess that they cannot be closed. This burden to all English people, and especially to the wholesale sugar users, should be done away with now when the country's revenues show a surplus of about seven million pounds sterling. Only a few days divide us from the Budget declaration, and let us hope that this troublesome tax, the tax of our breakfast table, will be removed.

The Brussels Sugar Convention.

So much discussion has taken place lately regarding the usefulness or otherwise of this Convention, which came into force 1st September, 1903, and lasts till August 31st, 1908. It has been so many times undeservingly abused. It is a Free Trade measure pure and simple, establishing equal and undisturbed Free Trade in sugar all over the world. The principal object of this Convention was to rule the world's sugar market according to supply and demand, and free it from any protective artificial measures (such as Government grants, bounties, doles, and cartels). It is noteworthy that this Convention owes its existence to a Conservative Government. Now to think of it that a Liberal Government, at present in office, whose first point on its programme is Free Trade, should commit itself to opposing this

* Mr. Stein is here giving expression to the *Liberal* opinion. The Unionist Government who introduced this tax did not regard it merely as a war tax; its advent was welcomed as a means of broadening the existing basis of taxation, and for this latter reason it was not revoked at the termination of the Boer War.—(Ed. *I.S.J.*)

measure and denouncing the Convention. This would simply mean that the Liberal Government had broken with the long-observed principle of Free Trade. I cannot imagine for a moment that our statesmen would be so short-sighted as to destroy this Convention, which is really a masterpiece corresponding with the views of the majority of the population.

Should the unforeseen happen and should the Convention be denounced by Great Britain on the 31st August, 1907, I do not think that it will be abandoned by the other Powers, or the bounty incubus be re-created.

The bounties have gone, and cannot be revised again. The simple reason is that no Continental country can afford to pay grants or bounties, because the finances of the different countries forbid it. The heavy taxation on the continent, which leaves scarcely anything further to be taxed, the financial state of the different countries and the monetary situation cannot allow the different Exchequers to again extract money from the taxpayers to support a single industry.

And why should foreign governments support again an industry, if this latter has proved during its existence under the Brusssels Convention for 3½ years that it can exist and work profitably without any state aid and grants?

No, the bounties are dead for ever!

Several opponents of the Brussels Convention bring forward the argument of the prohibited sugars of Argentina and Russia. At present these sugars go elsewhere, filling the wants of other countries. Supposing these two sugars should come to England after the denunciation of the Convention the price of sugar would not be lower, because other sugars which come at present to England would go where Argentina and Russia send their sugars now. It would simply mean an exchange of origin in sugar supply. The price of sugar is not ruled by one country alone, and sugar would not be cheaper by a single farthing.

The consumption of sugar on the continent is increasing daily, and in Germany, for instance, the home consumption has increased from 9·50 kg. per head in 1891-2 to 16·59 kg. per head in 1905-6.

To revert once more to the proposed British sugar industry, a beginning will have to be made in the two largest counties, namely, in Lincolnshire and Yorkshire, because the supply of beetroots could easily be contracted for and be cheaper than in the Midlands or East Anglia.

As stated before, the capital necessary is at least £60,000, under which sum no factory must open its doors.

All the schemes floating about the country with capitals of £30,000 to £40,000 are nonsensical, and too much warning cannot be given to the public not to venture on such ridiculous undertakings.

CHEMICAL RESEARCH IN THE DUTCH INDIES.

The following statement regarding the organisations existing in the Dutch East and West Indies for the chemical investigation of natural products, has been communicated by Dr. Greshoff, who was formerly in charge of the chemical laboratory attached to the well-known botanical garden at Buitenzorg, in Java, and since 1890 has been Director of the Colonial Museum at Haarlem, in Holland.

Chemistry is studied almost entirely as an applied science in the Dutch East Indian Colonies. In Java there are three secondary schools, similar in character to the German Realschulen, which are provided with laboratories for teaching elementary chemistry. There is not, as yet, a native University, though the island is inhabited by a very intelligent race, anxious to obtain European instruction. The nearest approach to a University is found in the native School of Medicine at Batavia, which was founded in 1851 and has 150 pupils. It has a medical journal of its own, though this is of course not of the same importance as the Dutch Indian medical journal and the Dutch Indian journal of science, which occasionally contain chemical contributions; the former was started in 1853, the latter in 1850.

Chemistry has never been an intellectual luxury in Java, but has always been encouraged as a means of supplying the practical needs of life, especially on the agricultural side.

Through the influence of Prof. G. Mulder (1802-1880) when scientific adviser to the Dutch Colonial Office, laboratories for the examination of minerals, and for the study of agricultural chemistry were founded. The latter was under the direction of Dr. Fromberg, at one time Assistant to Prof. Johnston at Edinburgh. This laboratory was closed when Fromberg died in 1858.

Mulder was of opinion that the prosecution of chemical research in Java might be made part of the duties of pharmacists attached to the army of occupation, and this led to the establishment of the Army Medical Service Laboratory at Batavia, which is now chiefly used for the preparation of drugs. Though Mulder's high expectations were not realised, useful contributions to chemical science were not infrequently made by the military pharmacists appointed under this scheme, thus van Gorkom, Moens, van Leersum, all of whom were pharmacists in the Army Medical service, brought chemistry to the aid of cinchona cultivation, and it is exclusively owing to chemical control of the Java cinchona plantations, that the methods of selection and cultivation have been greatly improved, so that Java now has practically a monopoly of the trade in cinchona bark. The production of cinchona bark in Java is about 7,000 tons per annum, equivalent to seven-eighths of the world's consumption. In 1903, a large new laboratory for the investigation of problems connected with

the cinchona plantations was established by the Dutch East Indian Government in the Preanger.

Whilst the Goverment took the first step in applying science to cinchona cultivation in Java, to private initiative was due its introduction into most of the other colonial agricultural industries. In 1886, when there was great distress in Java among sugar planters in consequence of the great fall in prices, and of the "tereti" disease of the cane, the more energetic planters saw that the aid of science must be sought. Almost simultaneously, three Institutes for sugar chemistry and sugar agriculture were founded, each in a centre of the industry, and each fitted up and maintained by the Planters' Association. Numerous Dutch scientists have worked in these institutes, and the practical results obtained have exceeded the most sanguine expectations. From year to year the yield of sugar per acre has been increased, disease has been warded off, the manufacturing methods have been improved, and now Java is in the forefront of cane-sugar producing countries, the production of cane-sugar having risen from half-a-million to one and a tenth million tons per annum during the last ten years.

The literature which has been issued for these sugar laboratories in Java is too voluminous to be mentioned here, though reference may be made to the Journal for the sugar industry, which has been published since 1893, and is considered one of the best technical journals of its kind. In the chemical study of the sugar cane the the foremost worker in Java is Prinsen Geerligs, Director of the laboratory for Sugar Analysis at Kagok-Pekalongan. It is owing to him that there has been introduced into Java a system of "mutual control" in manufacture, by means of which every factory can compare its own results with those of other factories—a system of working which would probably also be useful to European laboratories engaged in agricultural and food analysis.

Following the example of the sugar planters, other branches of agriculture in Java have started their own laboratories. Since 1892, a laboratory for the investigation of problems connected with indigo cultivation has been at work in Klaten, and to its efforts is due the Javanese method of extracting indigo from the Natal indigo plant (*Indigofera arrecta*). In the case of indigo, however, chemistry has the difficult task of fighting against one of its own triumphs, viz. artificial indigotin. It is certain that, owing to scientific advice, the Java indigo planters will be able to compete more advantageously than planters in many other countries with the German works, and if prices remain moderately good, they may perhaps even be able to hold their own. Investigations on indican and indigotin of benefit to the Java indigo industry have also been carried out during recent years in Holland, partly in the Haarlem Laboratory, but especially in the laboratories of the technical high school at Delft.

A laboratory for cocoa investigation was started in Java under the directorship of Dr. Lehntner, who subsequently took charge of a similar institution in Brazil.

Perhaps the most important aids to planting progress in Java have, however, been furnished by the Chemical Laboratory attached to the Government Botanic Garden (Lands Plantentuin) at Buitenzorg. Since 1880 these gardens have been under the influential direction of Prof. Treub. Last year they were reorganised, and became the Government Department of Agriculture.

The agricultural chemical investigations carried on at Buitenzorg, with the support of the planters concerned, have been more especially those connected with tea in Java and with tobacco in Sumatra (Deli). The tea investigations have been in progress since 1893, and have greatly increased our knowledge of this important plant. The reports published on the subject in Java in the Dutch language have remained almost unknown in other countries.

There are two general chemical laboratories at Buitenzorg, one for pharmacological chemistry opened in 1887, and since 1892 under the direction of Boorsma, and the other a laboratory for agricultural chemistry which was from 1890-1903 under the able direction of van Romburgh, now Professor of Organic Chemistry at Utrecht University.

It is to be regretted that the Buitenzorg researches have been limited to the flora of Java itself, and even to those plants which can be grown in the abnormally damp climate of Buitenzorg, for unfortunately, none of the other Dutch East Indian Islands has a botanical garden. Mention may be made in passing of the analysis of tropical fruits now being made under Boorsma's direction, which is complementary to the detailed investigation of East Indian foodstuffs, now being carried on in the writer's laboratory at Haarlem, where already 400 different East Indian food products have been analysed.

Close scientific relationships are maintained between Holland and its East Indian Colonies, and most Dutch botanists and some chemists make a point of working for a period at Buitenzorg. Java has provided Holland not infrequently with University professors, who have made a name in the Colonies. In this way the scientific ties between the mother country and the Colonies are strengthened, but the continuity of the work in Java is often broken thereby.

In spite of what has been done in applying chemistry to agriculture in Java, much yet remains to be done. The existing agricultural laboratories are insufficient to supply information for new branches of tropical agriculture, and there is an almost complete absence of provision for commercial and technological work. The examination of imported foods for adulterants, and of drugs, and artificial manures, is practically unknown in Java. Provided that the imported articles have not been damaged by sea water, nobody is

concerned about their purity. Similarly no special provision is made for physiological and toxicological investigations.

In conclusion, a few words must be said about the Dutch West Indian Colonies.

From several causes, such as the want of cheap labour, the migration of the sugar industry, the diseases of the cocoa plant, Dutch Guiana for many years has not been in a flourishing condition. That there is now an earnest desire in the mother country to improve the condition of things, is shown by the fact that twice in succession a Dutch cabinet minister has left his office to become Governor of this small colony. It is also this desire for improvement which has brought about the foundation at Paramaribo of experimental gardens, a laboratory for agricultural chemistry, and a department of agriculture.

It is proposed that, as soon as the new agricultural department in the Dutch West Indies is in working order, botanists and chemists from Holland shall regularly visit this colony in order to carry out their scientific investigations, and to collect material for study. A beginning has been made already by Professor Wend, of Utrecht, formerly director of an agricultural laboratory in Java, who, with his pupils, is preparing a preliminary flora of Dutch Guiana and the Dutch West Indian Islands.—(*Bulletin of the Imperial Institute.*)

ON ASCERTAINING THE STRENGTH OF CONCENTRATED LIME JUICE BY MEANS OF A HYDROMETER.*

By the Hon. FRANCIS WATTS, C.M.G., D.Sc.

In a previous paper submitted to the Agricultural Society of Dominica, and published in the *West Indian Bulletin* (Vol. V., pp. 236-40), I made suggestions for the use of a hydrometer for ascertaining approximately the strength of lime juice. In that paper it is stated that the hydrometer and the table may be used to ascertain approximately the strength of concentrated lime juice by carefully diluting the concentrated juice with water to ten times its volume. This may conveniently be done by accurately filling with concentrated juice a flask holding exactly 100 c.c., then transferring this juice to a flask holding 1,000 c.c. (1 litre), and filling up the 1,000 c.c. flask with water. The small flask must be carefully washed out with the water used for diluting, so that all the concentrated juice measured in the 100 c.c. flask is transferred to the large flask.

The hydrometer is floated in the diluted juice, the reading noted and multiplied by ten to give the strength of the concentrated juice.

* This paper was communicated to the Dominica Agricultural Society and published in the *Official Gazette*, February 3rd, 1906, for general information.

Thus:—If the hydrometer floats at 1,029 in the diluted juice, the strength is, approximately, 11·04 oz. per gallon; or, in the concentrated juice, 110·4 oz. per gallon.

It should be pointed out that with anything but pure solutions the results are only approximately correct, but it is believed that they will be sufficiently accurate to be useful in ordinary estate practice.

Since the above was written, I have had an opportunity of examining several samples of concentrated juice, by the method stated, and of comparing the results with those obtained by titrating with alkali. It must be remembered that even titration by means of alkali does not accurately determine the true citric acid, but only the free acidity, which may be due in part to acids other than citric.

The results were as follows:—

Mark.	Sp. Gr. $\frac{30° C.}{15.6° C.}$ Reading of instrument in diluted solutions.	Oz. of citric acid per gallon by table, assuming 82 per cent.*	Oz. of citric acid per gallon, by titration with alkali.	Difference.
Layou Park	1·0309	117·1	124·54	− 7·4
St. Aroment	1·0321	121·5	118·7	+ 2·8
La Haut	1·0234	90·1	89·6	+ 0·5
Hampstead	1·0326	123·3	116·9	+ 6·4
Corlet	1·0326	123·3	108·2	+15·1
Pointe Mulâtre	1·0255	97·6	99·0	− 1·4
Lisdara	1·0308	116·8	109·3	+ 7·5
Bagatelle	1·0304	115·4	109·3	+ 6·1
Hampstead B.	1·0268	102·3	97·7	+ 4·6
,, C.	1·0257	98·4	95·9	+ 2·5
,, D.	1·0275	104·9	104·0	+ 0·9
,, E.	1·0245	94·0	92·7	+ 1·3
,, F.	1·0259	99·0	96·8	+ 2·2
,, G.	1·0378	142·0	138·0	+ 4·0

The above will show what approach to accuracy may be expected in the use of the hydrometer with concentrated juice.

With two exceptions, those of Layou Park and Pointe Mulâtre, the indications of the hydrometer are higher than the results obtained by titration, the difference being variable and ranging from about 1 oz. up to 6 or 7 oz.

* An arbitrary assumption was made in constructing the table (*West Indian Bulletin*, Vol. V., pp. 238-40), namely, that the impurities or substances, other than citric acid, might be approximately allowed for by assuming that the citric acid present in the juice is 82 per cent. of the amount which would be indicated in pure citric acid solutions.

The case of the sample from Corlet appears to be exceptional, and I anticipate that inquiries will show that this was not a normal sample of juice.

From this it appears that by means of the hydrometer and the table a planter can ascertain approximately the strength of the concentrated juice which he is producing, and can introduce into his work a measure of control which has hitherto been wanting.

What is necessary now is that the planters shall insist in the use of the citrometer in determining the point to which juice is to be concentrated, and then that each lot of concentrated juice, after diluting as described above, shall be tested by means of the hydrometer. The indications of the hydrometer should then be compared with those of the citrometer ascertained during the process of concentration. Should the hydrometer indications be too high, the workman should be instructed to boil to a lower degree on the citrometer. Should a higher concentration be wanted, he should be instructed to boil to a higher degree accordingly.

Very little care and observation on the part of the planter will enable him to concentrate to any point which he may fix upon as most desirable.

My observations led me to conclude that in the past there was a tendency in Dominica to concentrate to too high a degree. This was due to the impression that by concentrating, say, 12 to 1, instead of 8 to 1, there is a great saving of freight and packages. This is true in some degree, but high concentration is accompanied by destruction of citric acid. If the freight and packages of a cask of concentrated juice cost, say £2, and the juice be worth, say, £15, then a saving of one-third of the freight and packages will effect a saving of 13s. 4d.; a loss of 5 per cent. of acid will entail a loss of 15s., and a loss of 10 to 15 per cent. of acid may easily occur from over-concentration, entailing a loss of 30s. to 45s.

Moreover, I am informed that the purchaser of concentrated juice prefers to have his supplies concentrated to a moderate degree, concentration from 95 to 100 oz. being preferred to that of 130 to 140 oz.

I can only repeat the advice which I have already given. "Carry on the concentration until the citrometer, when immersed in the juice at boiling temperature, shows a density of 60°." The concentrated juice thus obtained will contain about 100 oz. of citric acid per gallon. If on testing the resultant juice with the hydrometer in the manner described, it is found to be too highly concentrated, then a lower degree on the citrometer must be taken as the point to which to concentrate. There will be variations in each district, so that the correct point can only be found by experiment.

With the combined use of the citrometer and the hydrometer, the planters have the means of producing concentrated juice of a uniform quality, and of approximately learning its strength.

I have recently adopted a method in examining concentrated lime juice which gives interesting comparative results. If a mixture be made by diluting 100 c.c. of concentrated juice with water to 1 litre, and poured into a tall graduated cylinder, to stand over night, it is found that the liquid deposits a bulky black sediment, the volume of which may be noted after standing about 20 hours.

In the samples above reported on, the volumes observed were :—

Mark.	Volume of Sediment. c.c.	Mark.	Volume of Sediment. c.c.
St. Aroment .. .	95	Hampstead B	30
La Haut..	75	,, C	40
Hampstead..	40	,, D	20
Corlet	85	,, E	40
Pointe Mulâtre	50	,, F	40
Lisdara	55	,, G	65

The amount of sediment in several of the samples from Hampstead is particularly small.

CANE DISEASES.

From various quarters applications have been received asking advice as to what is best to be done to check the spread of a disease called "Blight" on Sugar Estates in Trinidad. An examination has been made by the officers of the Botanical Department of several of the Estates on which the so called "*Blight*" has appeared, and numerous specimens collected which have been examined. Several Estates have also been visited by the writer.

Attention was first called to the matter by the appearance of an insect belonging to a class known as the "Frog Hoppers" or "Cuckoo spits"; the immature form of the insect jumping readily and covering itself with a frothy exudation. This insect was examined and reported upon by the Department in 1889-1890 (16 years ago); and the report was published in the *Agricultural Record* of that period, Vol. II. 1890, p. 126. Later determinations afford considerable evidence of the corrections of the record of observation it contains.

The following is a reproduction thereof in full :—

Report on Sugar Cane Blight.

"In November, 1889, I visited the district of Chaguanas by the request of the District Agricultural Board for purpose of investigating the cause of a "blight" among the canes.

2. With the assistance of Mr. Laing of *Perseverance*, I was able to obtain information which leads to the conclusion that the cause of blight is due primarily to the attacks of an insect belonging to family *Cercopidæ* and the *genus Thomaspis*. In these insects the mouth is adapted for suction, the tongue being channelled, and surrounded by

lancet-like organs, with which the tissues of plants are pierced. All the insects of this group subsist on vegetable juices and do incredible damage to crops.

3. It is to be noted that certain climatic conditions appear to favour the reproduction of the insect, as the evidence shows that the effect of their action on the plant is always most noticeable after a long period of wet weather succeeded by a sudden drought.

4. The larva of the insect appears to be developed near the surface of the ground about the roots of the plant upon which it feeds, and there is distinct evidence of the punctures made by the insect when the roots are subjected to microscopic examination.

5. The roots attacked by the insects die, and the leaves of the cane suffer in proportion as their supply of food is cut off. On the specimen examined nearly all the roots were completely rotten, but the stem of the cane itself was in apparently good health and free from the attacks of Fungi, and would probably have recovered by the growth of new roots from above the damaged parts, if a suitable period of weather had prevailed.*

6. The perfect insect was found in several instances attacked by a fungus which in the ordinary course is probably one of its natural enemies. To assist in checking the ravages of the insect it may be found useful to dress the roots of the cane with applications of quick-lime, soot, wood-ashes, or any other substance which would be inimical to the insect while harmless to the cane. This appears to be all that can be done while the crop is growing; but in badly affected places I should deem it advisable to burn the whole surface of the land immediately the crop is taken off, as this would destroy the eggs of the insect and thus necessarily reduce the numbers present during the next season.

7. Not being able to determine the particular species to which the insect belongs, specimens were forwarded to England with the object of obtaining further information.

Mr. McLachlan, F.R.S., who has been so kind as to examine the insect decides that it belongs to the family to which it was in the first place referred, viz., the *Circopidæ* or "Cuckoo-spits," as they are familiarly known in England; but it cannot yet be ascertained that the particular species is known or described. In addition to the remedies which I have suggested and Mr. McLachlan approves, he recommends that the specially affected portions should be treated with paraffin emulsion, *i.e.*, a mixture of "pitch oil" and soap and water. He also recommends that it would be well to ascertain whether the insect is found suspiciously frequent on other plants growing on the same estate, and if so, to have them destroyed.—*Agricultural Record*, Vol. II., January-June, 1890.

* This has actually been proved to be the case, nearly all the area affected having for the greater part recovered through the advent of suitable weather.

It is to be noted that our knowledge of cane diseases has been largely extended since the publication of the report of 1890. In the following years considerable attention was given to the study of such diseases, and several reports were made, one of which by Mr. W. F. H. Blandford was published in the *Agricultural Record*, p. 103, Vol. VII., 1892, which discussed the matter in full, and summarised the evidence to date, principally dealing with the attack of Xyleborus perforans or shot borer. In it, however, Mr. Blandford discusses an observation made by the writer of present paper, (viz.) that he had found the cane affected by the mycelium of a Fungus, and says, "*this is so important that it will be well to throw further light on the* subject, by having the canes examined by *an expert in Phytopathology*." Steps were taken to follow Mr. Blandford's advice, and specimens were submitted, the result being that a parasitic Fungus was found and described by Mr. Massee of Kew, from material sent from Trinidad, and Barbados, and named Trichosphæria sacchari or Rind Fungus. Mr. Blandford also suggested that *the possibility of Fungus disease of the roots should be considered*, and this has also been studied, a fungus found, and its action very completely described in several publications of the Imperial Department of Agriculture, but more fully in Lectures on the diseases of the sugar cane by L. Lewton-Brain, B.A., F.L.S., the mycologist of the Department. Older evidence of the various diseases is also given in *Agricultural Record*, Vol. VII., p. 78, 1892, in a report by the late Dr. Cruger, formerly Government Botanist, who in regard to Fungi, anticipated, that while most of those he had noted were saprophytic; "*that forms or states of development of them may infest the living tissue*," which forecast has also proved true.

In the report on *Cercopideæ* made by the writer, no mention is made of parasitic fungi attacking the cane, as, at that time, none had been determined; but notice was taken of the parasitic fungus, attacking the *Thomaspis* or Froghopper, now known to belong to the order *Entomophthoraceæ* a *genus* of which (*Empusa*) is known to destroy the common house fly and other insects. This fungus undoubtedly hastens the disappearance of the "Froghopper" whose attack can only be considered of secondary importance. This fungus bears no near relation to those which attack the cane. Further observations tend to show that the "Froghopper" is not uncommon on gramineous plants, and specimens were taken in abandoned fields covered with the ubiquitous "Para Grass" on which it generally appears in numbers in similar seasons to that of 1906.

In 1889 and 1890 the attack of the "Froghopper" was followed by an attack of *Trichosphoeria* or "Rind fungus."

In some fields considerable numbers of "moth-borer" were present (*Diatria Saccharali*). Also the cane beetle (*Sphenophorus sacchari*) and one of the so-called "Mealy bugs" known as (*Dactylopius sacchari*), all of which are known to reduce the vitality of the cane. On some

Estates the canes were found badly infected with the root fungus (*Marasmius sacchari*) and on these the attack of the *Cercopideæ* or "Froghoppers" insects appeared more pronounced than on other fields; where better health prevailed, but even these, suffered considerable damage. The effect of the "Root fungus" is well described by Mr. Lewton-Brain in his paper read before the Agricultural Conference held at Port-of-Spain, in January, 1905. He says (*West Indian Bulletin*, Vol. VI, No. 1, p, 34): "*Root disease of the Sugar Cane, is caused by a Bacidiomycetous fungus (Marasmius sacchari) the same fungus attacks sugar cane in Java, while another species of the genus attacks Bananas in the West Indies (M. semiustus). The disease is one that has caused great loss in Barbados, especially in the season before last, when weather conditions were unfavourable to the growth of the cane.*"*

"The symptoms are first those of a deficient water supply. The leaves roll up and finally become dry and wither, the tips and edges showing the effect first. Fewer leaves, also, are developed. The lower leaf-sheaths, instead of falling off leaving the stem clean, remain attached, and when examined are found to be matted together by a white mycelium and the whole has a characteristic musty smell. The young roots when examined are seen not to be developing properly, the tips are red and black and they remain short. The stools, generally are dwarfed and easily uprooted. The last stage is development of toad stools; these are found usually, in rainy weather and in the early morning, at the base of the attacked stools; they are small, white delicate structures, bearing the spores on gills on the under side of the cap. They may spring direct from diseased roots or from the malted leaf-sheaths."

"The fungus is a facultative saprophyte and its mycelium is capable of living indefinitely on decaying cane stumps so long as conditions are favourable, that is, in the absence of much air and light.

"It attacks the cane plant indirectly first developing on dead leaves, dead roots, &c., and finally attacking the root tips. Here it destroys the growing region and so prevents root development.

"Under favourable conditions the sugar cane is capable, to a great extent, of overcoming the attacks of Marasmius. *It is only when root development is checked that great damage is done.*—(Italics ours.)

"The fungus spreads by its spores but mainly by its underground mycelium, spreading thus from diseased plants to healthy ones in the neighbourhood. This gives us one way of checking its spread namely by digging a trench around an attacked area. The trench should be about 18 inches deep, and should include one or two rows of apparently healthy canes. * *Good cultivation, by promoting root development and admitting light and air, will also check the growth of the fungus.* Diseased canes should not be allowed to ratoon, for it is as ratoons that canes are most severely attacked. * *Whenever possible*,

* (Italics ours.)

infected land should be rested from cane cultivation for at least two years. Cotton forms a good rotation crop.—(*i.e., for Barbados J. H. H.*)

"Old cane stumps infested with the mycelium of *Marasmius* are a frequent source of infection. These should be dug out and destroyed. Another point is to use only very healthy, vigorous cuttings, to give the plants a good start. Sometimes, even now, cuttings are taken from plants which are too poor to be crushed; the folly of this in giving the fungus a good start with the new crop is obvious. Great care should also be taken in supplying to us only healthy plants.—(*West Indian Bulletin, Vol. VI., No. 1, p. 34*)."

The statements made in the preceding extract are of vital importance, and we are of opinion that they point out the leading cause of the present attack. In the present season, a continuous period of dry weather occurred, during which, plants could not make good progress. This was followed by a continuous wet season, which would also be a check to healthy growth. The conditions therefore were especially favourable to the development of "Root disease," and canes that were attacked by it, naturally suffered most from the attack of insect pests. Sir Daniel Morris as President of the Conference, in referring to one of the fungus diseases said "*In the case of a disease so widely spread it may be that it existed among canes for a long period, but only came into prominence when the canes were weakened and not in good health, due to unfavourable condition.*"

It may be gathered from evidence collected, that the present so called "Blight," is in reality due primarily to an unfavourable season, and that the attack is most severe, on those lands where antiquated practices are followed; and where conditions exist favourable to the development of fungus diseases. The practice of procuring supplies for replanting from abandoned or ratoon fields, cannot be too strongly condemned, although in some cases it is still followed. It is given on authority (page 35, Vol. XI., *West Indian Bulletin*) that "old cane stumps are a frequent source of infection," "diseased canes should not be allowed to ratoon, for it is as ratoons that canes are most severely attacked." There can be little doubt that *the enemy* in the form of fungus or insect pests, is always present, and that the best results follow where measures tending to check the spread of such pests are adopted. The canes which have suffered most are those where fungus disease is prominent, or where the conditions are such as to hinder development of healthy growth in the cane.

So far as the writer has seen there appears at present, to be nothing new in the present attack nor anything which has not already been contended with, and there is every probability that with the re-appearance of favourable seasons, the "Blight" of 1906 will practically disappear, provided suitable measures are taken to prevent the propagation of fungus diseases.—(J. H. Hart in *Trinidad Bulletin.*)

THE BEET SUGAR INDUSTRY IN SWEDEN.

(From the *Centralblatt.*)

Sweden, though possessing a somewhat scanty population, is with its area of 170,000 square miles, one of the largest states in Europe. Between latitudes 55 and 69 it has a length of 970 miles and a breadth of 150 to 280 miles.

It follows that in so extensive a strip of land the climate and the soil conditions must show wide differences in the different localities. Since olden times, the country has been divided into three provinces or "lands" of which the most northerly, that of Norrland, comprises more than half the kingdom. Here the nomadic tribes known as Laplanders live.

In this "land of the midnight sun" agriculture takes a very small part while in the southern portions of the province mighty forests abound which contribute to Sweden's principal article of export, viz., timber. In the farthest north lie the well-known iron mines which yield annually over a million tons of ore. The second province, Svealand, often incorrectly termed Mid-Sweden, lies south of Norrland and includes the Swedish lake district; it may be considered as the real "hub" of the kingdom. Here thrive the common cereals oats, rye, barley, and even wheat, all ripening well; and here agriculture, mining, and forestry, and their offshoots, form the chief industries.

The most southern and also the richest and most fruitful region of Sweden is Gottland. For quality of soil, extent of population, and development of agriculture and industry, this province lies little behind the best areas in Mid-Europe. Here the Swedish beet sugar industry first saw the light and has now attained to such a high standard of excellence.

As early as the thirties of last century beets were grown here and industrially worked up into sugar and syrup. The results were, however, not encouraging, for the output cannot have exceeded 3% on the roots, so that after a few years other cultures were substituted. The next attempt was not made till 1850 and the subsequent years. Then factories were erected, not only in Scania, the southernmost district, but also in the more northern situated East Gottland, and likewise in Svealand near to Stockholm. Although this time an output of 8% was obtained, the factories ceased working after a few years, save one in Scania which managed to keep its head above water till more prosperous times arrived. This was the factory of Arlöf, near Malmö, which at the present day is, thanks to complete reconstruction, one of the finest industrial concerns in Sweden.

In 1883 the third and still existing period of beet growing in Sweden commenced. In that year there was erected at Sabyholm

near Landkrona amidst the old beet growing districts a new factory, which for that period was one of the largest and most up-to-date in existence. Hereupon the ice seemed at last to be broken. The good results accruing from this undertaking proved an incentive to the erection of other similar factories. By 1900 15 factories were in existence, of which 13 were in Scania, and simultaneously through the enlarging of existing works the average daily output of the whole lot of factories increased from 4,000 to nearly 12,000 zentner of roots worked up. At the same time the acreage under beet culture increased year by year.

At last, however, the feverish expansion met with a serious check, inasmuch as the demands of the home market could no longer keep pace with the increase in sugar production. This contretemps first arose in 1896 when the raw sugar production exceeded 105,000 tons whilst the annual consumption required but 80,000 to 90,000 tons. Owing to the existing conditions of excise which did not allow a rebate of duty on export, the export of the surplus production was not feasible, so that for the time being the endeavours of the leading men in the sugar industry were directed towards regulating the production so as to make it correspond as nearly as possible to the needs of the home markets. The regulation of production has on the whole succeeded well, though in individual years owing to the unknown factors influencing a crop either a large surplus or a deficiency has been met with. In the latter event the requirements were met by importing raw sugar, mostly from Germany.

The demand for refined sugar which is at present 100,000 tons or about 44 lbs. per head increases but slowly, and is easily met by the existing refineries whether the raw material be indigenous or imported. Very few new factories have been built within the last decade.

Of the new factories, there are two in East and West Gottland, nearly 3° of latitude further north than the majority of the other concerns. But the length of time they have been at work—one or two campaigns—is yet too short to enable an opinion to be formed whether the beet sugar industry can flourish in that region. In this part of Sweden exists a wholly continental climate with short hot summers and early and severe winters, whereas in Scania the climate is decidedly insular in character. It is therefore evident that the modern requirements for beet culture, apart from conditions of soil, are quite different for the two new factories as compared with the older attempts. We will therefore confine ourselves in the following notes to giving particulars of the older concerns.

As above mentioned the Scania climate, which is tempered by sea breezes coming from three quarters of the compass, is particularly favourable for beet cultivation. The summer is not so hot as further inland, while on the other hand the winters are not nearly so rigorous. Autumn is usually mild and prolonged, snow seldom

falling before Christmas. The harvesting of the roots, which commences at the beginning of October and is in full swing a fortnight later, can be carried on till the middle of November without fear of frosting. Indeed, instances might be cited where the work has been continued into December without any damage having ensued. In this case, however, there is always a risk of the crop being damaged if not ruined by frost. Likewise the working day gets so short that it becomes of doubtful advantage to have so late a crop. On the other hand it must be observed that as the beetroot gains both in weight and sugar content during the last period of its growth, it is advisable to leave it in the ground as long as possible in order to let it attain the maximum degree of ripeness. Sowing takes place at the end of April or the beginning of May. The crop output is similar to that in Germany, averaging 30,000 kg. to the hectare. Obviously, however, there are considerable variations in the average according to the particular soil or year. At one time outputs as much as 10 % higher were recorded, but those only occurred under exceptional conditions of soil. Moreover, the masses of soil clinging to the roots used to be included in the weights sold to the factories, thus making the crop larger than it was in reality.

As most of the roots are delivered by rail, the factories have at nearly every station of the beet districts special sidings with weighing apparatus, where the roots are delivered. As the congestion, especially at the commencement of the season is very great, not all the roots can be delivered at once by the railway, but are stored in special places till railway wagons can be found to take them away to the factory. For later delivered roots which are stored by the farmers themselves, the so-called "winter price" is paid, being an additional 20 öre per 100 kg. (2s. 2d. per metric ton). But those who wish to enjoy this additional price must deliver just when it is convenient to the factory. In the autumn when deliveries are made for the "autumn price" every contractor has the right to deliver as many roots as he chooses to the factories or the railway depôts. As to the prices, it must be observed that these are in general very high, much more so than in any other beet growing country. This is due to the very favourable tariff which the Swedish industry enjoys. Nevertheless there have been fierce disputes between the factories and the farmers over the question of prices; the result is that the former *fixed* prices have given place to fluctuating ones, which starting with the generous minimum of 2 kronen per deciton (1·11 mks. per zentner or 21s. 8d. per metric ton) for 14 % beets take into consideration any higher sugar content or the price of sugar. There is, however, a peculiar arrangement, that the average sugar content for any given factory shall determine the price paid, so that all who deliver to one factory get the same price, and any additions in the price for sugar content are applicable to all the contractors. The detailed investiga-

tion of the roots of each individual contractor is thus avoided, and the mean yield of the slicing machine is the only one to be considered.

At the commencement Sweden's sugar industry was not burdened with taxes. In 1855, however, a stock tax was instituted, which has been in vogue till just lately. But the officially circulated output, and correspondingly the duty, has been raised according as the real output has become greater. From 6½ % it has risen by degrees to 12 %. The actual output has, however, always been somewhat higher, and has attained to 15 % in the last few years. If it be remembered that the duty was only one-half or even two-fifths of the real sugar duty, it will be seen that the industry has enjoyed specially favourable treatment on the part of the State. Consequently it has not only been able to make large profits, but has also, as above mentioned, been able to pay a price for the roots never elsewhere met with. But on September 1st of last year the old tax was superseded by a new direct tax. Henceforth the sugar which goes into consumption will have to pay a tax of 13 öre per kg. Any imported raw or refined sugar will be liable to a tax of 11¾ and 17 öre respectively. Sweden as we know is a party to the Brussels Convention, but like Spain and Italy does not require to reduce the import duty to the limits of 5 and 6 fr. respectively, so long as she does not export any sugar.

CANE FARMING IN TRINIDAD AND MAURITIUS.

Cane farming, or cane growing, or the tenant system, as it is sometimes called in Louisiana, or the colonos, as the cane growers are called in Cuba, has become such an important factor in the cane sugar industry of the world that it seems unfortunate that considerable opposition to this method of securing canes has existed in Trinidad, notwithstanding the fact that in the year just past nearly half the sugar cane produced in Trinidad was produced by cane growers and not by the sugar estates themselves. The Journal of the Trinidad Agricultural Society reports that for the year 1906 the estates' cane ground reached 397,912 long tons, and the cane farmers supplied 237,844 tons. For this about $2 per ton was paid, or $469,122 for it all. These cane farmers were composed of 6,127 East Indians and 5,446 West Indians.

But the sugar planters of Trinidad have not been disposed to give the canes of the cane farmers an equal chance with their own canes. In other words, no regular central factory system has developed by means of which a daily or weekly pro rata delivery is established. Without some such arrangement giving all the canes coming to the factory an equal chance, cane farming can never attain its full proportions. If the cane farmers' canes are to be rejected or held back until all of the plantation canes are harvested, the farmers

would naturally be discouraged because occasionally they would lose their crops, as some of them have done in Trinidad.

The enormous proportion, however, of the crop of sugar cane now raised by cane farmers in Trinidad, shows what a keen interest the cane growers are taking in this method of farming. It is assuming nearly as large proportions as the same kind of cane growing has already assumed in Cuba, and promises in the end to become the dominant method of cane production everywhere, just as similar methods already dominate the beet growers in the beet sugar world.

Seemingly the objection to cane farming in Trinidad has been the absorption of a considerable amount of good labour in cane farming which were it not for the facilities granted by such farming, would otherwise be concentrated in and on the large sugar plantations. On the part of some persons there has been a disposition to discourage cane planting, based upon the opinion that if no such industry were known the labour supply of Trinidad would be much greater than it now is. This, however, seems to be a collision with the natural order of things, and while the cane farmers may produce far smaller crops per acre than the plantations themselves produce for their own account, at the same time they are their own masters; they do not have to obey the order of any one and this freedom is what they want, and they are content with smaller returns. It would seem to us wise for the cane planters of Trinidad to encourage this method of cane growing, even if it absorb all the available lands and even if all of the cane grown in Trinidad is grown in this way. The great factories could then concentrate their attention upon the manufacture, in getting the best results possible in extraction and the quality of the manufactured product, and that division of labour would probably redound to the mutual benefit of the present cane planters and the cane growers.

In Mauritius, on the other hand, cane farming has been quite successful and has been very well thought of by all concerned. It is said, in fact, that the small farmers have been the salvation of the island and that they are now the real backbone of the country. While cane farming, if not actually discouraged, has hardly been encouraged in Trinidad, in Mauritius it has been actively stimulated by land owners, who were willing to dispose of their land in small parcels, selling them for cane growing only, until the purchase price and interests were fully paid up. This condition in the deeds of sale of the land required that all of the canes grown on the tenant's land had to be weighed on the cane buyer's scales and the market price of the district paid. The cane growers provided their own carts, oxen and mules for transporting the cane to the railways or to the factories and the greater the distance from the factory to the weighing station or receiving point for the sugar cane, the less price was paid for the cane and generally a deduction of six cents per ton per mile was

made for railroad hauling. Nine rupees per long ton, or about $3 gold, has been the usual price of sugar cane brought to the cane carrier, sometimes more and sometimes less, depending upon the value of sugar.

Some parties report that in Mauritius they could buy canes in this way more cheaply than they could grow them, but that nine rupees was about the average cost of cane production.

One single corporation in Mauritius had recently on its books the names of some 5,000 cane farmers who had bought land and had not fully paid the purchase price. Their lots usually were from one to ten acres in extent, and their general bargain for the land was 300 rupees, or about $100 per acre, payable in five annual instalments, with interest upon the unpaid balance at nine per cent. The crop is to be cane only and is to be delivered to the central factory until the purchase price and interests are paid for.

It is said that in Mauritius there was quite an active competition between the factories for farmers' cane, and it was presumed that when the larger land sellers had collected all the money that was due to them and the cane growers were permitted to sell their canes wherever they liked, proportionately higher prices would rule. In Trinidad it seems that the cane farmers, to a considerable extent, simply produce crops on leased lands. Not having an ownership in the lands, their culture was very poor, and it is said that the average yield of sugar cane ran down from five to six tons per acre, and the lands were finally abandoned as unprofitable. On the other hand, in Mauritius, the farmers generally cultivate their land fairly well and some extremely well. Any of those who are negligent or careless workers, of course suffer in yield and will probably fail in the end.

This distinctive difference between Trinidad and the Mauritius still persists. In Trinidad the cane farmers are presumed to do very imperfect work and to secure but limited yields of cane. In this way the labour system diverted to cane farming is thought to do a real injury to the country, based upon the supposition of the cane planters that if they had personal control of the labour engaged in cane farming, under such control they could get double or triple the crops that the farmers realize where they grow the canes under their own control and without competent supervision. The matter of ownership of the land in Mauritius seems to remedy this evil. In Trinidad the remedy is presumed still to come.—*(Louisiana Planter.)*

The Canadian Government has announced that it will allow the manufacturers of beet sugar to import foreign raw beet at preferential tariff rates, in the proportion of two pounds to one pound of refined sugar from Canadian beets. The object of this is said to be to enable the factories to run for a longer period during the year.

NOTES ON THE INFLUENCE OF CONCENTRATION ON THE POLARIZATION OF CANE PRODUCTS.

By H. & L. Pellet and Charles Fribourg.

We commence with the rotatory powers of sucrose, glucose (dextrose), and lexulose, as given in Maguenne's treatise on "Les Sucres et leur Principaux Derivés."

Sucrose.—For solutions of average concentration (5 to 30%) the rotatory power is about 66·5°.

Calderon (1876) has given:— $[\alpha]_D = + 67{\cdot}9^\circ$

$[\alpha]_j = + 73{\cdot}2^\circ$

Narini and Villavechia give:—

$$[\alpha]_D = 66{\cdot}438 + 0{\cdot}010312\, p - 0{\cdot}00035449\, p^2$$

Tollens:—$[\alpha]_D = 66{\cdot}386 + 0{\cdot}015035\, p - 0{\cdot}0003986\, p^2$

Landolt:—$[\alpha]_D = 66{\cdot}67 - 0{\cdot}0095\, p$

Mascart and Benard:—$[\alpha]_D = 66{\cdot}54$ for a solution containing 16% and at 20° C.

From these results it is seen that the rotatory power of sucrose is slightly lowered in proportion as the concentration is increased.

Glucose (Anhydrous).

Tollens:—$[\alpha]_D = 52{\cdot}50 + 0{\cdot}018796\, p + 0{\cdot}00051683\, p^2$

Soxhlet:—$[\alpha]_D = 52{\cdot}85$ for a solution containing 18·6%

Ost:—$[\alpha]_D = 51{\cdot}54$,, ,, ,, 10%

Salomon:—$[\alpha]_D = 52{\cdot}7$

Consequently, the rotatory power of glucose increases with the concentration.

Levulose.—Hönig and Tesser:—

$[\alpha]_D = -113{\cdot}96 + 0{\cdot}2583q$ (q being the water content of the solution).

Tungfleish and Grimbert:—

$[\alpha]_D = -101{\cdot}38 + 0{\cdot}56t - 0{\cdot}108\,(p - 10)$ for temperatures between 0° and 40° C., and for concentrations below 40%. (p = grams per 100 cc.)

According to Hönig and Tesser, a rise of temperature diminishes the rotatory power of levulose to the extent of 0·67 per degree Centigrade above 20° C.

By means of the preceding formula we have calculated the rotatory powers of the three sugars for solutions containing 20%, 10%, 5%, and 1% respectively.

Sucrose.—(Adopting Tollen's formula).

$C = 20\%$:—

$[\alpha]_D = 66{\cdot}386 + (0{\cdot}0015 \times 20) - (0{\cdot}0004 \times 400)$
$= 66{\cdot}386 - 0{\cdot}13 \quad \ldots\ldots\ldots \quad = 66{\cdot}256$

$C = 10\%$:—

$[\alpha]_D = 66{\cdot}386 + (0{\cdot}0015 \times 10) - (0{\cdot}0004 \times 100)$
$= 66{\cdot}386 - 0{\cdot}025 \quad \ldots\ldots\ldots \quad = 66{\cdot}361$

$C = 5\%$:—

$[\alpha]_D = 66{\cdot}386 + (0{\cdot}0015 \times 5) - (0{\cdot}0004 \times 25)$
$= 66{\cdot}386 - 0{\cdot}003 \quad \ldots\ldots\ldots \quad = 66{\cdot}383$

$C = 1\%$:—

$[\alpha]_D = 66{\cdot}386 + (0{\cdot}0015) - (0{\cdot}0004)$
$= 66{\cdot}386 + 0{\cdot}001 \quad \ldots\ldots\ldots \quad = 66{\cdot}387$

From these calculations it is seen that the rotary power increases with the dilution.

Dextrose (adopting Tollen's formula).

$C = 20\%$:—

$[\alpha]_D = 52{\cdot}50 + (0{\cdot}0188 \times 20) + (0{\cdot}0005 \times 400)$
$= 52{\cdot}50 + 0{\cdot}576 \quad \ldots\ldots\ldots \quad = 53{\cdot}08$

$C = 10\%$:—

$[\alpha]_D = 52{\cdot}50 + (0{\cdot}0188 \times 10) + (0{\cdot}0005 \times 100)$
$= 52{\cdot}50 + 0{\cdot}238 \quad \ldots\ldots\ldots \quad = 52{\cdot}74$

$C = 5\%$:—

$[\alpha]_D = 52{\cdot}50 + (0{\cdot}0188 \times 5) + (0{\cdot}0005 \times 25)$
$= 52{\cdot}50 + 0{\cdot}106 \quad \ldots\ldots\ldots \quad = 52{\cdot}61$

$C = 1\%$:—

$[\alpha]_D = 52{\cdot}50 + (0{\cdot}0188) + (0{\cdot}0005)$
$= 52{\cdot}50 + 0{\cdot}019 \quad \ldots\ldots\ldots \quad = 52{\cdot}52$

The rotary power of dextrose is therefore diminished by dilution being, in this respect, contrary to sucrose.

Levulose (adopting the formula of Tungfleish and Grimbert).—Assuming that in each case the temperature of the solutions is 20°C. this formula becomes :—

$[\alpha]_D = -\,101{\cdot}38 + (0{\cdot}56 \times 20) \quad \ldots\ldots\ldots \quad = -\,90{\cdot}18$

$C = 20\%$:—

$[\alpha]_D = -\,90{\cdot}18 - 0{\cdot}108\,(20 - 10)$
$= -\,90{\cdot}18 - 1{\cdot}08 \quad \ldots\ldots\ldots \quad = -\,91{\cdot}26$

$C = 10\%$:—

$[\alpha]_D = -\,90{\cdot}18 - 0{\cdot}108\,(10 - 10)$
$= -\,90{\cdot}18 - 0 \quad \ldots\ldots\ldots \quad = -\,90{\cdot}18$

$C = 5\%$:—

$[\alpha]_D = -90{\cdot}18 - 0{\cdot}108\,(5 - 10)$

$= -90{\cdot}18 + 0{\cdot}54$ .. .. $= -89{\cdot}64$

$C = 1\%$:—

$[\alpha]_D = -90{\cdot}18 - 0{\cdot}108\,(1 - 10)$

$= -90{\cdot}18 + 0{\cdot}97$.. .. .. $= -89{\cdot}21$

The rotatory power of levulose diminishes proportionately to the dilution when the temperature remains constant.

Comparing the foregoing data, we obtain :—

Concentration. Per cent.	Sucrose.	Dextrose.	Levulose ($t = 20$).	Invert Sugar (equal parts of Dextrose and Levulose).
20	66·26	53·08	— 91·26	— 19·09
10	66·36	52·74	— 90·18	— 18·72
5	66·38	52·61	— 89·64	— 18·52
1	66·39	52·52	— 89·21	— 18·35

In the column headed "Invert Sugar," the concentrations would be 40%, 20%, 10%, and 2%.

Taking the rotatory power of a 20% solution of sucrose as = 100 (namely, the recently proposed normal-weight), we obtain the following figures for an average temperature of 20° C. :—

Concentration. Per cent.	Sucrose.	Dextrose.	Levulose.	Invert Sugar.
20	100	80·11	— 137·73	— 28·81
10	100·15	79·59	— 136·10	— 28·25
5	100·18	79·40	— 135·28	— 27·94
1	100·19	79·26	— 134·63	— 27·69

Here, again, the concentrations for invert sugar should be doubled.

Having observed certain differences in the polarimetric readings of the same substances, Mr. Noël Deerr attributes their difference to the influence of the degree of dilution on the rotatory power of the substance examined. On examining cane juice and solutions of cane molasses (diluted to 20° Brix.) he obtained an increase in the polarization when the solutions were diluted by one-fourth their volume of water (after correcting the polariscope readings for such dilution).

In his first series of experiments he found variations of from + 0·20 to + 0·30 for juice (polarizing from 25 to 27), and + 0·40 to + 0·50 for molasses (polarizing 16 to 23).

In a second series of experiments, he obtained :—

Juice diluted	$\frac{1}{6}$ showed an increase of	0·43	Original Polarization = 27.
,, ,, ...	$\frac{1}{4}$,, ,,	0·27	
,, ,, ...	$\frac{1}{2}$,, ,,	0·20	
Solution of molasses diluted	$\frac{1}{6}$,, ,,	0·44	Original Polarization = 14.
,, ,, ,,	$\frac{1}{4}$,, ,,	0·36	
,, ,, ,,	$\frac{1}{2}$,, ,,	0·24	

We have shown above that different degrees of dilution produce slight variations in the rotatory power of sucrose, but that these variations are greater in the case of dextrose, and still more so in the case of levulose, provided that the polarizations are fairly high. The practical consequences are as follows.

In the case of juice, which contains much sucrose and little reducing sugars, the differences due to dilution should not be as great as in the case of molasses containing the maximum proportion of reducing sugars.

Assuming that the latter consist of equal quantities of dextrose and levulose (which is sufficiently exact for our present purpose) we will take a sample of cane molasses of the following composition.*

Total solids (actual Brix)	84
Sucrose	43
Reducing sugars	14
Ash	13
Organic matters	14
Water..	16
	100
Purity	51·2

A solution containing 20 grams of this sample per 100 cc. will contain :—

Sucrose..	8·60
Reducing sugars	2·80
Ash	2·60
Organic matters	2·80
Total solids	16·80

By calculation we find that a solution containing 8·60% sucrose will have a rotatory power of :—

$$[\alpha]_D = 66{\cdot}386 + (0{\cdot}0015 \times 8{\cdot}6) - (0{\cdot}0004 \times \overline{8{\cdot}6^2})$$
$$= 66{\cdot}386 - 0{\cdot}016 \quad \ldots \quad = 66{\cdot}37$$

Similarly, for the reducing sugars, containing 1·4 of dextrose and 1·4 of levulose, we find :—

Dextrose.—$[\alpha]_D = 52{\cdot}50 + (0{\cdot}0188 \times 1{\cdot}4) + (0{\cdot}0005 \times 1{\cdot}4^2)$
$$= 52{\cdot}50 + 0{\cdot}036 \quad \ldots \quad = 52{\cdot}54$$

Levulose.—$[\alpha]_D = -90{\cdot}18 - 0{\cdot}108\,(1{\cdot}4 - 10)$
$(t = 20)$ $\quad = -90{\cdot}18 + 0{\cdot}93 \quad \ldots \quad = -89{\cdot}25$

Invert Sugar.—$[\alpha]_D = -\dfrac{36{\cdot}71}{2} \quad \ldots \quad = -18{\cdot}35$

* Quoted from our paper on "The Solubility of Sucrose in Solutions of Invert Sugar," (Bulletin de l'Association des Chimistes de Sucrerie de France, September, 1906.)

Taking 66·37 = 100, the rotatory power of the invert sugar becomes :—

$$\frac{100 \times (-18{\cdot}36)}{66{\cdot}37} = -27{\cdot}66$$

Similarly, the polarization of the original molasses would be :—

Due to sucrose	=	43·00
,, reducing sugars $\left(\frac{14}{100} \times -27{\cdot}66\right)$....	=	− 3·87
or		39·13

We next dilute the molasses solution by one-fourth so that it contains 5 grams molasses per 100 cc. Its composition becomes :—

Sucrose .. .. 2·15

Reducing sugar ·70 $\begin{cases}\text{dextrose } 0{\cdot}35 \\ \text{levulose } 0{\cdot}35\end{cases}$

On calculating the rotatory power as before, we obtain for :—

Sucrose. — $[\alpha]_D = 66{\cdot}386 \times (0{\cdot}0015 \times 2{\cdot}15) - (0{\cdot}0004 \times \overline{2{\cdot}15}^2)$

$= 66{\cdot}386 \times 0{\cdot}0014$ .. .. $= 66{\cdot}39$

Dextrose.—$[\alpha]_D = 52{\cdot}50 \times (0{\cdot}0188 \times 0{\cdot}35) \times (0{\cdot}0005 \times \overline{0{\cdot}35}^2)$

$= 52{\cdot}50$ .. .. $= 52{\cdot}50$

Levulose ($t = 20$).—$[\alpha]_D = -90{\cdot}18 \times 0{\cdot}108\ (0{\cdot}35 - 10)$

$= -90{\cdot}18 \times 1{\cdot}04$ .. .. $= -89{\cdot}14$

Invert Sugar at ·70% .. .. $\frac{-36{\cdot}64}{2}$ .. .. $= -18{\cdot}32$

Taking 66·37 = 100, as in the former case :—

Rotatory power of sucrose $= \frac{66{\cdot}39}{66{\cdot}37} \times 100 = 100{\cdot}03.$

,, ,, invert sugar $= \frac{-18{\cdot}32}{66{\cdot}37} \times 100 = -27{\cdot}60.$

Consequently, the polarization of the original molasses would be :—

Due to sucrose	$100{\cdot}03 \times \frac{43}{100} =$	43·01
,, reducing sugars..	$-27{\cdot}60 \times \frac{14}{100} =$	− 3·86
or		39·15

To resume, we have prepared two solutions, the one containing 20% and the other 5% of the same molasses (that is to say, solutions almost identical to those examined by Mr. Deerr), and we obtain polarizations of :—

39·13 for the 20% solution,

and 39·15 ,, 5% ,,

So far, then, as the rotatory power is concerned the influence of the dilution is nil, and this was to be expected from the data given above. The rotatory powers of dextrose and levulose are slightly increased in passing from a 20% to a 1% solution, but less so in passing from a 10% to a 1% solution. The rotatory power of invert sugar is subject to less variation under the same condition.

Mr. Deerr examined solutions of molasses which had been clarified by means of lead, which would precipitate a small quantity of levulose. We do not, however, think this would influence the result of our calculation, in which we have assumed equal quantities of dextrose and levulose.

Any influence of the alkalinity of the solutions in their rotatory powers should also be considered, but inasmuch as the alkalinity remains proportional to the quantities of the different sugars during dilution, such influence is not likely to be marked. In the case of juice containing only a small quantity of reducing sugars this influence would be nil.

In conclusion, we give the following results of our first experiment with cane molasses:—

With a solution containing 20 grams per 100 cc. = 39·13 polarization.
" " " 5 " " = 39·15 "

These experiments will be continued.

The Cuban crop receipts to date are said to be the largest on record. The total received at the six ports is 245,000 tons more than last year and 100,000 tons more than in 1905.

There are 57 sugar factories in active work in Queensland and two refineries; 2325 hands are employed at these establishments which represent a capital outlay of nearly two million pounds. The Queenslanders consume as much as 114 lbs. sugar per head of the population.

As an inspection of our advertisement columns will show, the entire plant of the Palmiste Factory, Trinidad, belonging to Messrs. John Lamont & Co., Glasgow, is to be offered for sale at the end of the present crop. Messrs. Lamont are evidently retiring from the sugar industry.

PUBLICATIONS RECEIVED.

LECTURES TO SUGAR PLANTERS. (Issued by the Imperial Department of Agriculture in the West Indies.) 176 pp. Paper Covers. Dulau & Co., Soho Square, London.

These Lectures to Planters were delivered about three years ago by Officers of the Imperial Department of Agriculture in Barbados, and are now reprinted with a view to wider circulation. Professor d'Albuquerque is responsible for three of them, and Sir D. Morris, and Messrs. Bovell, Maxwell-Lefroy, and Albert Howard for one each. They deal with the Natural History of the Sugar Cane, Soils and Manures, Planting and Cultivation, Insect Pests, and Fungoid Diseases. Though mainly intended for the West Indies, the contents of this brochure will be found of interest to planters all over the world. The price is only 1/-, but it would be as well to remind intending purchasers that the postage abroad will amount to half that sum in addition.

DISTILLATION OF ALCOHOL AND DENATURING, by F. B. Wright. 194 pp. and 33 illustrations. New York: Spon & Chamberlain. London: E. & F. N. Spon.

We are in doubt whether we can fairly describe this work either as a popular exposition of the subject for farmers and manufacturers as appears to be suggested in the preface, or else as an elementary text book dealing fully with the purely manufacturing side of the industry. The bulk of the work is devoted to a good general description of the methods of preparing alcohol from the usual raw materials. The underlying principles of these methods are clearly set forth in readable style, but information concerning capital outlay for plant, cost of raw materials, and value of product must be sought for elsewhere. The chapter on denatured alcohol is disappointing, though, of course, the names, and in some cases the quantities, of the substances in common use for the purpose are given. Little if any information is given in these pages which cannot readily be found elsewhere, and, indeed, the whole book gives an impression of being a compilation of such matter as came readily to hand. The use of alcohol for power purposes receives but superficial treatment; the efficiency of alcohol motors and the calorific value

of various liquid fuels being dismissed without figures and in few words. The writer overlooks the obvious fact that the use of alcohol as motive fuel is likely in the near future to outdistance its present use for all other purposes combined, or at any rate he appears to regard this rather as a pious hope than as a prospect to be backed by monetary investment. One wonders whether it is necessary for the purposes of the book or whether its value is greatly increased by including a chapter on alcoholometry, and the same remark may apply to the 30-page quotation from the Statute Book of the U.S.A. It is no doubt customary in a certain class of work to include bulky matter, but Mr. Wright's own writing is so good where it appears that we could dispense with references which are obtainable elsewhere.

The eighth edition of the HACENDADO MEXICANO's yearly SUGAR REPORT has just been issued. It contains a list of all the factories in Mexico, Central America, Argentina, Peru, Porto Rico, Cuba, Hawaii, and Java. There is also some reading matter wherein is described several of the sugar factories in the Mexican Republic and elsewhere, and we observe that a short note which appeared in this Journal from the pen of Noel Deerr is reproduced. As there is always a demand on the part of the trade for an up-to-date directory, this one will doubtless prove of value. The price is not given but we think is $5 a copy, and it can be ordered from the *Hacendado Mexicano* office, Prolongacion Cinco de Mayo 11, Mexico, D.F.

Greenock sugar imports have been well up to the average so far as the year has gone, although stocks have been kept low in the hopes of a change in the sugar duty.

Recent negotiation set on foot amongst German refiners to form a Cartel have fallen through for the present. Some of the largest refineries declined to join the Trust unless the manufacturers of raw sugar entered the combine as well.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Application.

4620. M. Altolaguirre and J. Zubilaga, London. *Apparatus for defecating cane juice.* (Complete specification.) 25th February, 1907.

Abridgments.

2859. A. Ahrberg, Halle, a/S, Germany. *Improvements relating to centrifugal machines used in the manufacture of sugar.* 6th February, 1906. This invention relates to an arrangement for the preparation of sugar-plates, bars, and the like in the annular liners of centrifugal machines, in which the excess of boiled sugar or masse-cuite allowed to run into the sugar moulds in order to ensure that they shall be perfectly and uniformly filled up, is left lying in the form of sugar over the inner edges of the liner, after the centrifugal treatment is ended, and is removed by being sawn off or cut off, characterized by the application and use of an annular saw, which is revolved about a vertical axis, and is introduced into the liner of the centrifugal machine after the treatment of the sugar has been completed.

14122. W. A. Lynde, of Didsbury, Manchester. *An improved method in the manufacture of saccharin.* 20th June, 1906. This invention relates to an improved method in the manufacture of saccharin. Saccharin is usually manufactured from toluene; but other substitution products of benzene, such as yield on oxidation, or which contain without previous oxidation, benzoic acid, may be employed.

GERMAN.—Abridgments.

179039. Bromberger Maschinenbau-Anstalt G.m.b.H., of Prinzenthal, near Bromberg. *A stone catcher adapted to be thrown out of action in apparatus for washing sugar beet, potatoes, and other roots.* 2nd February, 1906. In this washing apparatus, a drum divided into chambers is revolubly mounted in a separate cylindrical casing, fixed on the outside of the washer in front of a grating, in which casing apertures are provided both towards the stone catching chambers of the washer and to the outside, in such a way that the chambers of the drum may be brought into communication by apertures in the drum casing with the stone catching chamber, either for the purpose of receiving stones, when the opening in the casing leading to the outside is closed by the drum casing, or when the apertures in the drum casing are open for the purpose of removing the stones to the outside, whilst simultaneously the drum casing closes the stone catching chamber of the washer. A further improvement of this

removable stone catcher consists in a revoluble, weighted, semi-cylinder being arranged over the drum, which by yielding upwardly prevents stones becoming jammed between the drum cylinder and the casing.

179040. Paul Rassmus, of Madgeburg. *A method for assisting the extraction of the juice or water from vegetable materials, more particularly beet shreddings by pressing.* 16th December, 1905. In this method the vegetable materials or shreddings are brought in contact with carbonic acid before or during the pressing, in order to assist the extraction of the juice or expulsion of water.

179543. Hermann Hoppe, of Magdeburg. *An arrangement in stirrer arms for washing bulbous roots and in particular sugar beet.* 20th January, 1906. This arrangement consists in the provision of rigid projections in the form of warts, teeth, pyramids, cones, or wedges in any suitable number and distribution on the surface of the stirrer arms of washing apparatus, in order to clean the recesses in the roots.

179635. Carl Steffen, of Vienna. *Method of obtaining pure concentrated beet juice and saccharine pressed residue of low water contents.* 5th January, 1902. This process consists in entire (unsliced) roots being treated for the purpose of obtaining a heat transmission, such as is described in claim 4 of German Patent 149593, by being subjected during the shredding to the action of suitably large quantities of crude beet juice heated to temperatures of from 60°—100° C., the material acquiring the desired temperature by the action of sudden transmissions of heat in consequence of the sectional surfaces being exposed. A modification of the process consists in already exposed parts of the sugar beet being subjected to the action of a treatment with hot juice in the manner described in claim 4 of German Patent 149593.

Note.—Copies of all published specifications with their drawings in these lists can be obtained from W. P. Thompson & Co., 6, Lord Street, Liverpool, at One Shilling a copy for English or American Patents, and Two Shillings for German. In ordering please give number and date.

Patentees of Inventions connected with the production, manufacture and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of February, 1906 and 1907.

IMPORTS.

Raw Sugars.	Quantities. 1906. Cwts.	Quantities. 1907. Cwts.	Values. 1906. £	Values. 1907. £
Germany	1,458,554	1,606,068	609,806	723,888
Holland	29,637	40,960	11,110	16,604
Belgium	136,420	82,769	55,647	34,798
France	123,707	10,278	52,378	4,968
Austria-Hungary	91,291	178,491	37,880	81,390
Java	87,958	32	41,451	13
Philippine Islands	....	....	....	....
Cuba	111,910	....	41,943	....
Peru	139,269	75,653	66,203	33,751
Brazil	186,965	186,047	75,753	73,369
Argentine Republic	....	....	....	....
Mauritius	20,861	94,883	8,344	38,103
British East Indies	....	....	....	....
Straits Settlements	13,032	31,982	5,751	13,748
Br. W. Indies, Guiana, &c.	220,301	217,279	129,180	125,515
Other Countries	12,538	59,021	5,956	29,044
Total Raw Sugars	2,632,443	2,583,463	1,141,402	1,175,191
Refined Sugars.				
Germany	1,664,626	1,861,169	954,729	1,080,028
Holland	381,853	458,813	230,332	284,377
Belgium	44,085	42,389	26,190	26,321
France	408,776	198,308	225,908	113,894
Other Countries	268	87	151	46
Total Refined Sugars	2,499,608	2,560,766	1,437,310	1,504,666
Molasses	357,119	399,491	76,254	78,306
Total Imports	5,489,170	5,543,720	2,654,966	2,758,163

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	111	158	103	101
Norway	2,672	2,421	1,648	1,426
Denmark	15,670	18,254	8,005	9,506
Holland	14,258	13,076	8,210	8,475
Belgium	1,327	1,479	723	805
Portugal, Azores, &c.	7,158	6,272	3,929	3,483
Italy	7,926	4,659	4,262	2,449
Other Countries	91,221	43,223	58,781	31,571
	140,343	89,542	85,661	57,816
Foreign & Colonial Sugars				
Refined and Candy	2,188	1,520	1,585	1,167
Unrefined	23,878	6,437	12,045	3,493
Molasses	2,767	23	808	8
Total Exports	169,176	97,522	100,099	62,484

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to Mar. 21st ..	488,788	..	391,181
Receipts of Refined ,, ,, ...	305	..	225
Deliveries ,, ,, ...	470,815	..	398,701
Consumption (4 Ports, Exports deducted) since January 1st..	351,800	..	347,515
Importers' Stocks, March 20th	17,973	..	31,013
Total Stocks, March 27th..	258,000	..	211,210
Stocks in Cuba, ,, ...	371,000	..	235,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1905-06 AND 1906-07.

(Tons of 2,240lbs.)	1905-06. Tons.		1906 07. Tons.
Exports	206,063	..	365,436
Stocks	138,828	..	285,090
	344,891	..	650,526
Local Consumption (two months)	7,970	..	8,230
	352,861	..	658,756
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 28th February ..	333,411	..	658,756

Havana, February 28th, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR TWO MONTHS ENDING FEBRUARY 28TH.

SUGAR.	IMPORTS. 1905. Tons.	1906. Tons.	1907. Tons.	EXPORTS (Foreign). 1905. Tons.	1906. Tons.	1907. Tons.
Refined	100,997	124,980	128,038	153	109	76
Raw	113,258	131,622	129,173	425	1,194	322
Molasses	12,430	17,856	19,975	9	138	1
Total..........	226,685	274,458	277,186	587	1,441	399

	HOME CONSUMPTION. 1905. Tons.	1906. Tons.	1907. Tons.
Refined..	101,648	120,224	126,623
Refined (in Bond) in the United Kingdom	80,176	91,213	82,394
Raw	13,977	20,317	14,499
Molasses	16,781	17,834	20,605
Molasses, manufactured (in Bond) in U.K.	9,523	10,930	12,783
Total..................................	222,105	260,518	256,904
Less Exports of British Refined.....................	3,297	7,017	4,477
Total Home Consumption of Sugar	218,808	253,501	252,427

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, MAR. 1ST TO 23RD, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1907.
152	1245	732	768	232	3129

	1906.		1905.		1904.		1903.
Totals	3459	..	2367	..	3193	..	3035

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING FEBRUARY 28TH, IN THOUSANDS OF TONS.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium. &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1834	1214	642,	549	204	4443	3864	4163

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.	1903-1904. Tons.
Germany	2,250,000 ..	2,415,136 ..	1,598,164 ..	1,927,681
Austria	1,335,000 ..	1,509,870 ..	889,373 ..	1,167,959
France	755,000 ..	1,089,684 ..	622,422 ..	804,308
Russia	1,450,000 ..	968,000 ..	953,626 ..	1,206,907
Belgium	280,000 ..	328,770 ..	176,466 ..	209,811
Holland	190,000 ..	207,189 ..	136,551 ..	123,551
Other Countries .	440,000 ..	415,000 ..	332,098 ..	441,116
	6,700,000	6,933,649	4,708,758	5,881,333

THE

INTERNATIONAL

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No. 101. MAY, 1907. Vol. IX.

☞ All communications to be addressed to The Editor, Office of *The Sugar Cane*, Altrincham, near Manchester.

All Advertisements to be sent *direct*.

Cheques and Postal Orders to be made payable to Norman Rodger, Altrincham.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTES AND COMMENTS.

The Budget.

It cannot be said that Mr. Asquith's second Budget is a humdrum affair, and yet there is nothing brilliant in it and it will cause dissatisfaction in many quarters. It is a strictly free trade measure, and so far from the basis of taxation being broadened ever so slightly, the opposite tendency seems to be the case, with the result that the country will receive yet another object-lesson in the necessity for fiscal reform. Naturally the Opposition make the most of this, and we sincerely trust that the impressions conveyed will take root in the minds of many who have hitherto clung for lack of further evidence to the old order of things. To descend to details, Mr. Asquith has not seen fit to alter any of the existing indirect systems of taxation. His sole palliative to the long-suffering taxpayer has been to promise a rebate of 25 per cent. in the income tax on moderate incomes, to wit, earned incomes under £2000. As to his reasons for not giving more relief, most persons will agree that some attempt to reduce the National Debt is very necessary; but the question of providing for coming schemes of social reform is one more open to argument, and one would like to know something more of the details of these schemes. For the present we have to be content with the hint that old age pensions may figure in the near future as a subject for legislation.

No tampering with indirect taxation means, of course, that the sugar duty will remain on for another year at least; and we have no doubt that in certain quarters this decision will create the keenest disappointment. If the confectioners really cannot make both ends meet without raising prices, then let them do so. But is it really true that times are so hard with them? It is, to say the least, curious that a leading firm in the confectionery trade who have adopted the praiseworthy scheme of sharing their profits with their employees for the past 17 years, should just recently have declared an annual profit-sharing bonus amounting to a larger sum than the *average*. To be exact, the latest declaration amounts to 8½ weeks' wages, whereas the average for the whole period is no more than 6½. This does not suggest that "the sugar duty and the Sugar Convention had hit the confectionery trade so hard" as their leaders try to make out. Most people would think a bonus of 16 per cent. on one's income a very satisfactory state of affairs. It would, however, be interesting to know what the bonuses have been each year since their inauguration. What were they in 1902 when sugar was so artificially cheap?

Before leaving the subject of the Budget it would be as well to place on record the reasons given by the Chancellor of the Exchequer for refraining from altering the sugar duty. Mr. Asquith said that the fact that it brought in £6,000,000 was a very strong argument for not lightly interfering with it. Objectionable as he thought it was, since it was a tax both on the food of the people and on the raw material of several important industries, yet it was not a duty that could be dealt with piecemeal. It amounted roughly to a halfpenny per lb., and as we did not deal in farthings in this country, any halving of the duty would not do any good whatever to the bulk of the consumers. On the other hand, to take off the duty altogether was out of the question at present, as it would seriously impair the existing sources of revenue. So the full duty must continue as before.

The Lead Precipitate Controversy.

Since our resumé of papers dealing with "Errors in the Polarimetric Determination of Sucrose," which appeared in January, 1906, further experimental evidence has come to hand regarding the influence of the lead precipitate on the concentration of sugar solutions and, more recently, the supposed absorption of sugar by the precipitate. Messrs. Pellet uphold the "absorption theory," which is denied *in toto* by Messrs. Horne, Deerr, Watts, Tempany, and others. As these contradicting views are said to be based on experimental evidence, a brief examination of the evidence may not be out of place.

M. L. Pellet finds that it is only necessary to wash the lead precipitate in order to render it free from sugar, but, as Mr. Deerr

points out, such simple treatment will very rarely remove an "impurity" which has been carried down, or entrained by any precipitate capable of absorbing substances from the solutions in which it is formed. So far from supporting the "absorption theory," we think that M. L. Pellet has helped to disprove it.

M. H. Pellet attacked the problem differently. He first decomposed the lead precipitate by means of sulphuretted hydrogen, filtered off the insoluble lead sulphide, and concentrated the filtrate by boiling. He assumed that this chemical treatment would not modify the complex organic matters on which he operated, so that, when subacetate of lead was added to his concentrated filtrate, the original lead precipitate would be reproduced, and its influence (if any) could be observed by adding different quantities of this "extract" to a sugar solution of known polarization and treating the mixture with subacetate of lead. In the *Bulletin des Chimistes*, September, 1905, M. Pellet states that "the influence of the precipitate was appreciable but less than that indicated by calculation from the weight and density of the precipitate." A year later, in a paper read before the members of the International Commission for Uniform Methods of Sugar Analysis, he states that "in spite of the presence of a notable proportion of lead precipitate, no increase in polarization was detected." Although his method of research appears to lack sensitiveness and fails to give him concordant results, M. Pellet concluded that there must be some compensating error to balance that due to the volume of the lead precipitate and, presumably, the "absorption theory" seemed the most promising. But Dr. Horne replies that "this is obviously only one of several explanations that might be given," whilst Mr. Deerr is still more explicit on the subject. Moreover, on repeating Pellet's experiments, Dr. Horne has succeeded in detecting a *plus* error which is easily accounted for without resorting to theoretical suppositions.

Not content with defeating M. Pellet with his own weapons, Dr. Horne has lately devised and executed a crucial test, described on another page, with the result that the "absorption theory" may now be decently buried. So far as this Journal is concerned, the discussion may be regarded as closed, and we hope that Messrs. Pellet will admit the impracticability of their assumption, and favour us in future with contributions of a more interesting nature.

The Identity of Seedling Canes in Demerara.

Some time back suspicion began to be felt that the cane cultivated on the well-known Diamond estate in Demerara under the name of B 208 was not the original seedling variety of that designation. This suspicion has now become an ascertained fact; we are also informed that the *Diamond* B 208 has been identified as the *White Tanna*, but this still requires confirmation.

How the confusion arose we are not aware, but with a system of mutual co-operation such as obtains in Java and Hawaii, such an error would have been detected before any harm resulted.

The results obtained at Diamond with seedling cane cultivation have been published periodically in the West Indian Press, and have attracted much attention and interest. But if our information as to the *White Tanna* is correct these results are of course invalidated, as the *White Tanna* is not a seedling cane but a bud sport from the *Striped Tanna.* And we fear that if on the strength of the Diamond estate results many other estates have tried B 208 seedlings, much annoyance not to say indignation will have been caused.

Cuba.

Owing to the long drought the Cuban plantations are rushing through their crops at unprecedented speed, but the ultimate total will not exceed 1,300,000 tons, if it reaches that figure. The cane is sweeter, but growth has absolutely stopped. By the middle of May most places will have finished, with the exception of the factories at the eastern end of the island, where, as a rule, they run on until August if they want to. Fires, intentional and accidental, have been very prevalent, but owing to the tinder-like condition of the country a spark starts a serious blaze. The largest sugar concern, probably in the world, "Nipe," has started up, but is experiencing all sorts of difficulties, so much so that it is improbable that they will get off the crop. Chaparra will actually make the largest crop of any sugar plantation, going close on to 400,000 sacks, say 60,000 short tons.

The political situation causes anxiety owing to the uncertainty that exists as to what the Americans intend doing; some British residents have notified their Minister that in the event of the withdrawal of the American troops the lives of themselves and their families may be endangered, and requesting him to make due provision for their protection. It is generally felt, however, that the American Government will have to remain on in some form or other.

Sugar prospects for next year will depend a good deal on the approaching wet season, the young canes are drying up, and will not give what was expected; *Colonos* are shy at going to any expense with new sowings, on account of the political situation and the probability of their fields being burnt up.

Beet Sugar Cultivation in England.

The committee of the Central Chamber of Agriculture have recently prepared a statement on Sugar Beet Cultivation for presentation to the Chancellor of the Exchequer, and we note with regret that they do not view with favour the establishment of a home beet

sugar industry under existing fiscal conditions. It is not questioned that good crops of beet, having a high saccharine yield, could be grown; it is the financial side of the scheme which strikes the committee as a doubtful one. The farmers must sign contracts to deliver roots for a certain number of years, but this they would only do if guaranteed a favourable price. On the other hand, the factory could not afford to pay such a price, unless its commercial success was assured in its initial stages by some Government aid. The statement suggests that a rebate of the excise duty within the limits allowed by the Brussels Convention, say 2s. per cwt., would meet the case very well, but this would be dependent on the retention of the present sugar import duties by Parliament. If, however, the Chancellor of the Exchequer thought that the import duty and the Brussels Convention would be likely to remain in force for at least another five or six years, then it could be respectfully urged that the case for granting such preferential treatment to sugar growers was at least as strong as that advanced by growers of tobacco in Ireland, to whom this favour is understood to have been accorded. The Chamber does not consider it within its province to indicate the exact methods by which the desired encouragement might be given, but it points out that, as large sums of public money were being devoted to finding employment in labour colonies in agricultural districts and Parliament was being invited to help to repopulate the rural areas, the adoption of this industry as the medium was well worth a trial. It would not compete with any existing home industries, and would be in time entirely self-supporting.

We learn that Mr. Walter Tiemann, well known to our readers as the writer of articles on Egypt in former issues of this Journal, after being engaged in the chemical trade in Germany for some years, has returned to his old occupation, sugar agriculture, he having been appointed director of some new experimental stations to be erected at Tucuman, Argentina. These will be run partly by the Government and partly by the Compañia Azucarera Tucumana, at which address Mr. Tiemann will be found.

Doubts are at times thrown on the success of the Naudet system of sugar extraction, but it is probable that the real reasons why it has not met with more rapid adoption are the expense of the machinery and, still more, the heavy royalty which the patentees at present see fit to charge. It may, however, be noted that the existing plant in Trinidad is reported to be working satisfactorily.

THE DENUNCIATION OF THE BRUSSELS CONVENTION.

The French View.

Monsieur Viéville's interesting speech at a recent meeting of the French Sugar Manufacturers' Syndicate is well worth reading, and we give below a translation of the main passages. France was the pioneer in the great continental beetroot sugar industry and showed the way for many years. It is rather sad, therefore, to feel that she is now outstripped by other countries, not only in the size of the crop, but also—a much more vital matter—in the cost of production. It was the great German and Austrian bounties of thirty years ago that gave those countries the impetus to outstrip their neighbour and instructor. But the fiscal system which gave them such a stimulus gave them also the basis of their present pre-eminence. It impelled them to grow rich roots and constantly to increase that richness. While France plodded on with a yield of about 5 per cent. of sugar from the roots, Germany was getting over 8 per cent. in 1871-2, over 9 per cent. in 1874-5, and about 11 per cent. in 1884-5. Then at last the French Government came to the rescue and gave their Fabricants the same fiscal system that their German competitors had been enjoying. The French yield jumped up from 5½ per cent. in 1883-4 to 9½ per cent. in 1887-8, 10½ per cent. in 1889-90, and 11½ per cent. in 1897-8. No wonder that during those years of progress the French crop increased from 265,000 tons to 730,000 tons. But, alas, the Germans had got such a start that they are still well ahead of France. This is the true key to the present situation so far as France is concerned. With their high yield in Germany—now round about 15 per cent.—they can beat France in cost of production. There are, of course, other reasons for their lower cost, but this is the main one. France is, therefore, hard put to it to compete on the terms of equality established by the Convention. It is a terrible struggle, as we can easily read between the lines of M. Viéville's interesting address.

In the passage in which he refers to the possibility—even certainty—that Germany and Austria would, if the Convention expired, revive their Cartels, he quite rightly concludes that the certain result would be another great fall in the price of sugar. But of course a fall below cost price would only come when the over-production, stimulated by the renewed high prices in Germany and Austria as the result of the restored high Customs duties, had once more glutted the markets of the world. Then we should be back again to the position in 1901-2. He thinks this would give great satisfaction to the British consumer. If so it would be but a short lived pleasure. No commodity can continue to be produced below the cost of production. Our blind statesmen and economists do not—or will not—see this; but the

great leaders of the German sugar industry saw it plainly enough in 1901 and did not hesitate to declare with no uncertain sound that as they had a Cartel bounty of about £5,000,000 a year their policy was to go on increasing their production and therefore keeping down the price well below cost of production, so that their competitors, whether cane sugar planters in the tropics or beetroot sugar manufacturers in Europe would gradually be compelled to go to the wall and leave them masters of the situation. How would those enlightened statesmen and economists, whose only object —for the sake of their pet supporter, the consumer—is cheapness, like the look of things when supplies fell off and prices rose. It would be no ordinary rise—not such a rise as in 1889, when the beetroot crop fell off and prices rose from 12s. to 28s.; or as in 1905, when the beetroot crop again fell off and prices rose from 8s. to 16s. It would be no little petty rise of a hundred per cent. like these, but something much more startling. Then would be the time for fiscal reformers to make themselves not only heard and listened to but also understood. The political economy of cheapness would then get its death blow.

M. Viéville does not touch on one essential point in connection with the course of prices and production since the Convention came into force. The effect of restoring freedom of competition in sugar production has not yet had the opportunity to make itself fully felt. A great accident happened in 1904, which upset the progress of natural causes. The beetroot crop of that year produced 1,200,000 tons less sugar than it would have done under normal conditions, and consequently visible supplies were suddenly reduced, speculators rushed in, and the price of sugar was doubled. This was a good and appropriate illustration of the effect of bounties in creating an overgrown industry in one particular corner of the world, and therefore compelling the consumer to be dependent for his supplies on the favourable weather of a circumscribed district. The mischief of it in this particular instance was that the high prices in January, 1905, caused every beetroot sugar manufacturer in Europe to contract for the largest supply of roots which his factory was capable of dealing with. Hence an enormous crop in 1905, and a rapid return to prices below the cost of production. Here again was a further illustration of the effect of bounties. They had created an exaggerated industry capable of producing more than two-thirds of the visible consumption of the world. In the one year its crop was deficient and the price was doubled; in the next the crop was a record, and prices fell to a point at which few producers could live.

These are the blessings which, according to our economists and statesmen, come from bounty-fed industries. To abolish bounties they say is contrary to the first principles of what they are pleased to called Free Trade.

The following are the main passages of M. Viéville's address to the French sugar manufacturers:—

"Was the conclusion of the Brussels Convention a wise step or was it not? The discussion of this question can have no more than an historical interest. Doubtless the old state of affairs could not have continued indefinitely. One may opine, however, that it would have been wiser to have proceeded with greater caution than was actually the case. Even our foreign neighbours were ready to offer to the French industry the benefit of a period of transition which would have alleviated the final consequences. But our Government considered it its duty to refuse the offer. To this day our industry has suffered in consequence.

"Immediately after the signing of the Brussels Convention we were asking ourselves what was to become of our sugar industry. Fortunately the course of affairs enabled us to present such a front as to avert every catastrophe predicted. A few factories, it is true, have had to shut down, but their number has been comparatively small. That the remainder have been able to continue has been due to their reserve funds, which have, however, been by no means inexhaustible.

"And now the time is approaching when under certain circumstances this Convention may be denounced.

"You are aware that though the Convention was only concluded for the five years ending September, 1908, yet provision was made for continuing it from year to year unless in the meantime it was denounced by the participants. If this denunciation is made by only one of the contracting parties, that country alone will be affected and the Convention will continue as heretofore as far as the remainder of the signatories are concerned. These latter would, however, retain till the 31st of October the right to second the denunciation, to take effect the following September. If this right were made use of, then the Belgian Government would have to summon within three months a Conference to meet at Brussels to deliberate what steps to take.

"In view of these possibilities, what attitude is the French sugar industry to adopt?

"Whatever differences of opinion we may entertain as to the merits or demerits of the Convention, I think I am right in assuming that we are unanimously opposed to the plan of asking our Government to take the initiative in denouncing it. For otherwise we should ere long find ourselves in a very awkward position, as we should be deprived of the means of obtaining the Government aid which we stand in so much need of. I do not think this point requires pressing on you.

"But if France does not ask for the destruction of the Convention, other countries may even now be preparing to denounce it. It is being asked on the strength of rumours coming from London whether there are not grounds for supposing that England intends to denounce the Convention and whether Germany and Austria, which at present maintain an attitude of complete reserve, will not in that case follow suit. Such suppositions are permissible and the best that we can do is to make our position as firm as possible.

"Suppose that the termination of the Convention is decided on. Must one not expect then that Germany and Austria will revive their Cartels and, as we saw them do in the past, throw their sugar on the English market at low prices. Shall we not see English prices sink to the extent of a large part of the bounty that these Cartels will give rise to? Certainly the English consumer will gain some advantage from this drop, and it is this alluring prospect which is at present being dangled before the eyes of the public by the opponents of the Convention in England.

"But from a national point of view one cannot consider only the interests of the consumer of a particular commodity to the neglect of the wider economic view. On the day that the price of sugar in the English market falls to the extent indicated above, the question will arise whether the British colonies will be able to produce sugar at the same low price so as to compete with beet sugar. I am sure they would not be able. And then would not these colonies be disposed to accept the offers of the United States, which has a much greater consumption than production. They might then benefit as do now the Porto Ricans. But this would be for England the loss—at least, moral—of her colonies, and is bound to make her Government hesitate, since no one can say for certain to what lengths the disaffection of these colonies will go.

"Very likely when England once more obtains artificially cheap sugar, she will respond by throwing on Continental markets sugared goods at unnatural prices. Will not this however induce Continental nations to follow the example of England in her treatment of bountied sugars and correspondingly ban the admission into their markets of confectionery made with such sugar? It will be seen then that the question is a very complex one and all conjectures are merely hypothetical. My own opinion is that it is unlikely the denunciation will come from England.

"Then, will it come from Germany and Austria, who between them could end the Convention? If so, then the circumstances will not warrant the conclusion of a new Convention with these two countries left out; in that case we should have to consider some method of combination which will place us in a somewhat better position than the Convention of 1902 did.

"In considering all this, we must perceive the necessity of not pressing matters to a conclusion; rather allowing *Time*, which is the best diplomat, the opportunity of solving the problem for us.

"But supposing the Convention were ended to-morrow, then we should have to apply to our Government to take such measures as would be necessary to place us in the same advantageous position as that held by our most immediate competitors, *e.g.*, the German and Austrian fabricants. Our Customs duties must be raised to the level of those existing in these two countries, and the special facilities accorded to their fabricants must not be denied to us.

"It is certain we shall amply protect ourselves; the means are not lacking. Our own Government dare not neglect their duty in extending aid, and we on our part must not be behind in organization."

The *Deutsche Zuckerindustrie*, in commenting on this speech, remarks that "interesting as are these statements of M. Viéville, they are based on a mistaken supposition. If he presumes that England will not denounce the Convention, then he may rest his mind with regard to Germany. *As far as our knowledge goes, the initiative for the denunciation of the Brussels Convention at the present time will not come from Germany.* The President of the Syndicate further said—what seems to us the most weighty pronouncement—that the French sugar industry would not advise their Government to denounce the Convention. This decision seems in full accord with that of their Government. For their Minister of Finance, M. Caillaux, in speaking at Lyons the other day, after claiming with some pride that the Convention was largely his work, said that his Government not only would not think of denouncing the Convention, but also hoped that the nation, on account of the incessant growth of injurious Trusts and Cartels, would renounce its national economics and bring its system of taxation in a line with international usage, as was done at Brussels in the case of the duties on sugar."

A new sugar refinery is about to be erected in Behar, Bengal, for the Maharajgunge Desi Sugar Co., Ltd., which will be capable of dealing with 20 tons of *gur* per day, and is intended to turn out a soft, light-coloured sugar, for which there is a considerable demand amongst high-caste native gentlemen. This refinery has been designed by Mr. A. E. Jordan.

REPLY TO CRITICISMS OF DRY LEAD DEFECATION IN RAW SUGAR ANALYSIS.*

By Dr. W. D. Horne.

About the only objections which have been raised to the method of defecating raw sugar solutions with anhydrous subacetate of lead, after making up the solution of the normal weight of sugar to 100 cc. and prior to polarizing, are those which Messrs. H. and L. Pellet have advanced.

Of the seven objections originally raised I answered all, but in the past few months Mr. H. Pellet has readvanced one of these in a new form, and has presented a new objection.

His new claim is that the lead precipitate absorbs sufficient sugar from solution to slightly more than counterbalance the concentration of solution which one would expect to find due to the occupancy of space within the 100 cc. by the lead precipitate formed.

In the other objection it is urged that anhydrous subacetate of lead added to a sugar solution dilutes such solution to the extent of ·37 cc. for each gram of reagent, causing through this dilution a corresponding lowering of polarization, and this also, he claims, just counterbalances the error due to the volume of precipitate. Experiments are cited to illustrate the first of these points in which a normal weight of raw sugar or syrup was dissolved in a small amount of water, defecated with lead subacetate solution and thrown upon the filter and then carefully washed free from sugar, the filtrate and washings being made up to 100 cc. and polarized. These polarizations are said to be the same as or a little higher than those obtained in the usual way, from which he concludes that the precipitate occludes or absorbs sugar. Obviously this is only one of several explanations that might be given, and if it can be shown that the precipitate does not absorb sugar, I am sure it must be admitted that Mr. Pellet's explanation is at fault and his deductions without weight.

In passing, I wish to point out the unsuitability of residual refinery or other syrups for the study of this phase of the question. I have already pointed out the dissimilarity of action of lead salts upon impurities existing in raw sugars and those existing in lower refinery products. Experiments upon syrups are not pertinent to this question.

In the experiments described below will I believe be found complete proof that the precipitate does not absorb sugar. It is admitted on both sides that whatever sugar may be associated with the lead precipitate, whether absorbed or not, is capable of being removed by careful washing upon a filter.

* Read before the New York Section of the American Chemical Society, April 5, 1907.

My contention is that the sugar solution surrounding the lead precipitate is of the same concentration as that filtered off, and in order to determine the accuracy of this contention, I experimentally determined by the most direct method possible the ratio of sugar to water in the filtrate from the lead precipitation, and again the ratio of sugar to water in the combined precipitate and that portion of the sugar solution adherent to it, and found that the sugar was a little less in proportion to the water in that part adherent to the lead precipitate than it was in the plain filtrate instead of being higher, as would be the case were Mr. Pellet's assumption correct.

26·048 grams of a Cuban molasses sugar was dissolved in a 100 cc. flask, 12 cc. of a solution of basic acetate of lead at 24° Brix. added, to obtain a satisfactory clarification, the whole made up to 100 cc. and filtered on a dry paper. To prevent evaporation the funnel was kept covered with a clock glass, and its stem passed through a perforated stopper into a 100 cc. cylinder with only a slight notch cut in the side of the stopper for the outlet of air. For the determination of water in the filtrate 1·0358 grams of the filtrate was transferred by a pipette to a closed weighing bottle, and after weighing rinsed into a flat 3-inch dish containing 30 grams of ignited sand which had been previously washed with hydrochloric acid. This was dried at first on an open water bath and later in a closed water-jacketed air bath at 98° C. until it came to a constant weight. The loss on evaporation was found to be 77·02%.

The sucrose was determined gravimetrically by obtaining the invert sugar with Fehling solution before and after inversion. 9·0440 grams of the filtrate were diluted to 200 cc. and 50 cc. (=2·2610 grains solution) added to 50 cc. Fehling solution, heating to boiling and kept boiling for two minutes. 100 cc. water free of air were then added and the whole filtered upon an asbestos plug in a Gooch crucible and ignited in a muffle furnace to CuO. This multiplied by ·7989 gave ·0566 grams of copper, which was calculated by Minson and Walker's tables (J. Am. Chem. Soc., Vol. XXVIII., p. 663, June, 1906) to be equal to 1·01 % of invert sugar. Another 50 cc. of the diluted portion was inverted with HCl, neutralized with sodium carbonate and made up to 200 cc. and 50 cc. (=0·5653 grams of the original solution) treated as before, giving ·2396 grams copper equal to 22·36% invert sugar. Subtracting the invert sugar first found from the total invert sugar and multiplying by ·95 gives 20·28% of sucrose present. Thus the sucrose in the filtered portion amounts to 26·331% of the water present.

The lead precipitate drained on the paper down to about 17 cc., when it was removed, rapidly mixed and 1·0268 grams weighed off for the determination of water as before. The water found was 69·96 %. Another portion, of 10·1385 grams, was weighed off and diluted to about 40 cc. and washed by decantation upon a filter and

afterwards directly upon the filter until the washings were free from sugar by the alpha-naphthol reaction. The volume was completed to 200 cc. and 50 cc. (= 2·5346 grams original precipitate) was precipitated as above, giving ·0769 grams copper, equal to 1·44% invert sugar in the precipitate portion. Then 50 cc. of the dilute portion was inverted, made up to 200 cc. and 50 cc. (= ·6337 grams of the precipitate portion treated as above, giving ·2413 grams copper, which equals 20·07% invert sugar. From this one calculates 17·70% of sucrose, which is only 25·300% of the water present. Thus the sugar solution around the precipitate is a little less concentrated than is the portion which filters off, instead of more concentrated as suggested by Mr. Pellet. It will be observed that the precipitate portion contained a little more invert sugar than the filtrate portion, which might be due to a slight inversion of sugar in the precipitate portion, or it might be due to a different selective effect of the precipitate for invert sugar from its attraction for sucrose. The latter would not materially affect the matter under discussion, but as the former would tend to give an unjust advantage to the argument for my contention, I believe it will be better to consider all the sucrose and invert sugar collectively as invert sugar and to use in our calculations only the weights of total invert sugar found in the different portions after inversion. Thus in the filtrate portion we have 22·36% of total carbohydrates expressed as invert sugar, and 77·02% of water. The invert sugar thus is equal to 29·03% of the water. Similarly, in the precipitate portion I find the total invert sugar is only 28·69% of the water. This relative increase in water over sugar in the precipitate portion certainly refutes absolutely the claim that the precipitate absorbs sugar and offers a strong suggestion that the very opposite is the case—that the precipitate absorbs water. This would be quite in line with the well-known tendency of many precipitates to come down in a hydrated condition.

I am further able to demonstrate mathematically that my results obtained experimentally lie very much nearer to the figures we should obtain theoretically, if my contention is correct, than they do to the figures we should obtain theoretically if the precipitate were capable of absorbing enough sugar to counterbalance the error due to the volume of the precipitate. Thus, the precipitate portion was found to occupy approximately 17 cc., and the specific gravity of the filtrate was 1·0995. The volume of the precipitate can be taken to be ·50 cc., as it was found to be just a little above this. Then assuming all the solution to have a density of 1·0995, there are, according to my analyses, 83 × 1·0995 grams of solution containing 22·36% of invert sugar = 20·4054 grams of invert sugar, and 16·50 × 1·0995 grams of solution in the precipitate portion containing 20·07% of invert sugar, equal to 3·6407 grams of invert sugar, making 24·0461 grams of invert sugar in the entire solution. Now, if enough of this is absorbed to

neutralize the effect of the volume of the precipitate, ·50/100 of it or ·1202 grams of it must be absorbed by the precipitate, placing 3·9678 grams in the precipitate portion and 20·0785 in the filtrate portion. As each gram of sugar in solution displaces ·62 cc. of water this transfer of sugar will cause a counterchange of water in the filtrate from 70·3113 grams to 70·3860 grams, and from 12·8842 to 12·8094 grams in the precipitate portion.

This will cause a variation in the ratios of sugar to water in the two portions, and on calculation it is found that the sugar should be 28·52 % of the water in the filtrate portion, and 30·98 % of the water in the precipitate portion. To recapitulate, the ratios of sugar to water in the two portions may thus be expressed, (1) according to the theory of no absorption, (2) the results actually found, and (3) according to the theory of absorption.

	Filtrate.	Precipitate.
1. Theory of no absorption ..	29·03 ..	29·03
2. Results actually found	29·03 ..	28·69
3. Theory of absorption	28·52 ..	30·98

Thus it will be seen that the theory of absorption would give us a difference between these sugar to water ratios more than seven times as great as that actually found, and in the *opposite* direction. I think no further comment is needed.

One of the reasons for the difficulty in determining whether the volume of the precipitate error is in any way counterbalanced by other errors is the inherent difficulty of knowing just what the correct theoretical polarization of a sugar solution is. With ordinary raw sugar or products containing matters precipitable by subacetate of lead it is greatly complicated by the presence of invert sugar and possibly other optically active bodies, by numeral salts and so on. But I have already pointed out in a previous paper a method of meeting these difficulties by adding to a pure sugar solution of known composition a definite quantity of optically inactive organic matter prepared from raw sugar, and then precipitating this with lead and polarizing the resultant filtrate, taking account of the volume of the precipitate formed.

Experiments made along this line have again demonstrated the absolute correctness of my claim that the polarization of a sugar is raised in exact ratio to the volume of the precipitate, and that my method of dry lead defecation in large measure overcomes this error. For these new experiments I prepared a solution of the organic matter of raw sugar by precipitating 1000 grams of low molasses sugar in 12,000 cc. of water with 480 cc. of a 24° Brix solution of basic acetate of lead, and washing by decantation with hot water until all sugar was removed, as shown by alpha-naphthol. The precipitate, suspended in water, was decomposed by H_2S, and the filtrate from PbS evaporated down to a brilliant amber or brown coloured solution of about 220 cc.

Then the following experiments were made :—

(*a.*) 26·048 grams dry granulated sugar + H_2O to 100 cc. was polarized .. .. Polarization = 99·6

(*b.*) 26·048 grams dry granulated sugar + 10 cc. organic solution + 1·5 cc. lead solution, being just about sufficient to precipitate the organic matter, the whole made up to 100 cc. and polarized .. .. = 99·7

(*c.*) Same sugar + 50 cc. organic solution + 7·5 cc. lead solution to 100 .. .. = 99·9

(*d.*) Same sugar + 50 cc. organic solution + water up to the 100 cc. mark, and 1·011 grams dry lead subacetate .. .. Polarization = 99·7

A portion of (*c.*) was used for determining the weight of the lead precipitate, its specific gravity found by Watts and Tempany's method, and from these figures the volume of the precipitate. Its weight was 0·7965 gram, its specific gravity was 2·497, and its volume ·319. As the precipitate occupies ·319 cc., it follows the sugar must all be included in the remaining volume of the 100 cc. flask, or 99·681 cc., and consequently we must multiply the obtained polarization, 99·9, by 99·681 % to give us the polarization as it would be, corrected for the volume of the precipitate; and we obtain as our result 99·58 as compared with our known 99·60 that we started with.

The results on (*b.*) are no less satisfactory, for the 99·6 polarizing sugar would be raised by the volume of precipitate present up to 99·656, and my reading was 99·7, which is less than half a tenth away—a difference which is perfectly admissible. In (*d.*) I obtained with 50 cc. of organic solution, using my dry lead defecation, a polarization of 99·7, as against a theoretical polarization of 99·6. As the volume of the solution was made up to 100 full cc. before the lead was added, there would be no factor present tending to increase the polarization, for we have the normal weight of sugar in the normal volume of solution. On adding the dry reagent a precipitate is formed having an ascertained volume of ·3 cc., but this cannot have the effect of concentrating the sugar solution unless it absorbs water, which is not claimed. According to the sugar absorption theory, however, it would have the effect in this case of reducing the polarization ·3 of a degree, giving us 99·3 instead of 99·6 theoretical and 99·7 determined.

At this point it is convenient to consider the second objection raised by Messrs. H. and L. Pellet in the *Bulletin de L'Association des Chimistes* for October, 1906, where they state that my dry subacetate of lead occupies a volume corresponding to 37 % of its weight, and that consequently when one adds 1 gram of this substance to the 100 cc. of sugar solution, the volume is augmented to 100·37 cc. As I added 1 gram of dry lead subacetate in the last-mentioned

experiment it would raise the volume to 100·37 according to this assumption, and this would have the effect of reducing the polarization from 99·3 as stated above to 98·93. But the results actually obtained are so very far from this figure, calculated according to the theories referred to, as to demonstrate beyond doubt that this latter claim also is entirely wrong and misleading. In the first place the subacetate of lead dissolved in pure water occupies a volume equal to 22 % of its weight and not 37 %, and in the second place very little of the subacetate goes into solution at all. Most of it forms a precipitate with impurities in the solution, and does not dilute the solution at all. The figures above quoted are a sufficient evidence of this, but to show how entirely erroneous the statements referred to are I will give the results of experiments conducted to cover this point.

26·048 grams of a muscovado sugar were dissolved in water and made up to 100 cc. exactly. As this sugar required 3 cc. of 24° Brix lead solution for proper defecation I next added its equivalent, or three times ·1348 grams of dry lead = ·4044 grams and after shaking filtered it. 25 cc. of the clear filtrate were acidified slightly with acetic acid and potassium chromate added in excess to precipitate lead, the whole boiled and filtered and washed on an asbestos plug in a Gooch crucible. The chromate of lead weighed ·0568 grams = ·0500 grams of dry acetate of lead, which × by ·22 and by 4 = ·044 cc., the total dilution caused by adding this amply sufficient amount of defecating material. This slight dilution is too little to affect the polariscopic reading at all. A molasses sugar of low grade that required 12 cc. of 24° Brix lead solution to give a satisfactory clarification was treated with an equivalent amount of dry lead and yielded in 25 cc. of the filtrate ·0544 grams of chromate of lead = ·04789 grams of dry subacetate occupying ·0105 cc. of volume, showing that in the entire 100 cc. of solution ·0420 cc. dilution was caused. Both of these amounts are below the possibility of materially influencing the polariscopic reading. Far less also is the influence of the much smaller amounts of dry lead required for the defecation of the higher grades of sugar, which constitute by far the larger part of the raw sugars of commerce.

These authors also advocate the use of Clerget's method of double polarization, before and after inversion as a way out of the difficulties arising in sugar polarization, but a little reflection will show that it will have no influence whatever toward correcting the error due to the volume of the precipitate, because both the original polarization and that obtained after inversion are made in the filtrate from the original precipitate and are both too high in proportion to the volume of the precipitate. The later operations of the test in no way correct the initial error of working on an over-concentrated filtrate.

The authors referred to have shown great zeal in presenting objections to dry lead defecation, and have brought into their arguments several extraneous issues which might lead to endless and indecisive

discussion. But I consider their latest claims as the most remarkable of all.

In the first place they perform an experiment which might have for one of its explanations the absorption of sugar by the precipitate. There are other equally good explanations possible, and, in fact, their results obtained exceed the possibility of this theory to explain. Nevertheless, they say the precipitate absorbs enough sugar to neutralize the effect its volume has on polarization, and so the ordinary polarization must be correct, and as the dry lead polarization is lower it must be too low by just so much.

Then in the second place, some time later, they calculate that dry lead added to the solution will dilute it just enough to make up for the difference between the two methods of polarization, and this time attribute the difference to this cause.

So they are in the unfortunate position of having explained away twice as much difference as ever exists, and that by indirect methods; while the most direct possible methods thoroughly demonstrate the fallacies of their claims and the superiority of the dry defecation over the process heretofore in use.

W. D. Horne.

Most up-to-date offices nowadays find a typewriter an indispensable adjunct to their work. There are, however, so many makes on the market, that some difficulty is likely to be encountered in selecting a suitable machine. The original types were practically all invisible writing (under-strike) machines, but despite this manifest disadvantage they possessed other such excellent features that they commanded a large sale. On the other hand, the early types of visible writing machines, although they gave the benefit of a more or less (often less) *visible* writing, were without many of the salient features of the older makes they attempted to displace. Their keyboard was harsh, their system of leverage badly designed, and as to their "visibility" it was often confined to the last line or two, or even to a narrow furrow down the centre of the paper. But a new pattern which has come into the market the last year or two seems to possess all the advantages of the older under-strike machines with the additional one of absolute visibility. This is the *Monarch*, made in Syracuse, New York, and as we have had some experience of its working, we can speak of it with confidence. The action is a *front*-strike one and the whole of the typed matter from the top of the page to the last word turned out is visible to the operator. The keyboard touch and the lever action are as swift and smooth as can be found in any of the best types. A special feature is the rigidity of the carriage; it is the type mechanism which is shifted up and down as required. We have no doubt that other users of this very solidly constructed typewriter will have cause to be satisfied with its capabilities.

THE INFLUENCE OF THE VOLUME OF THE LEAD PRECIPITATE IN CANE SUGAR ASSAYS.

A Reply to H. and L. Pellet and Ch. Fribourg.

H. and L. Pellet and Ch. Fribourg and myself are in agreement on this point:—Cane sugar solutions made up to different volumes in the presence of the lead precipitate, and observed at different concentrations tend to give nearly identical polarizations.

It is on the explanation of this phenomenon that we differ.

H. Pellet and Fribourg ascribe this to the lead precipitate at the moment of its formation entraining sugar. They do not as far as I am aware (I write open to correction) entertain the idea of change in the gyrodynat of cane products with varying concentration.

In the *Inter. Sug. Jour.*, No. 93, p. 458, H. Pellet writes, "Also, that if the lead precipitate absorbs sugar, the latter is separated by washing, as has also been recognised by Dr. Horne."

What is the exact chemical nature of entrainment we do not know. When it occurs elsewhere as in the precipitation of sulphuric acid by barium salts, or in the separation of lime from magnesia, the entrained or occluded matter is very obstinately retained, and can not be separated by simple washing. I do not think it reasonable to suppose that a precipitate can entrain or occlude matter which can be readily separated by washing.

The explanation that I give to the phenomenon is based on a change that occurs in the gyrodynats of cane sugar dextrose and levulose with varying concentration. The gyrodynat of cane sugar increases with dilution, those of dextrose and levulose decreasing. The rotation of levulose being negative, a numerical decrease will tend to alter the rotation of cane products in the same direction as that due to the cane sugar.

That this statement is well founded I need only refer to the classical determinations of Schmitz, Tollens, and others.

The points raised by H. Pellet and Fribourg regarding the quantity of the lead acetate used, and the accuracy of Brix hydrometers as purchased are entirely outside the subject of my initial communication.

The polariscope used in my experiments was a Schmidt and Haensch white light, half-prism polarizing, quartz wedge compensating instrument of very great accuracy.

The molasses employed were of composition approximately: cane sugar 33 %, reducing sugars 22 %.

I cannot admit that there is any difficulty in reconciling conclusions 1 and 3. My esteemed colleagues lose sight of the fundamental

point of my argument:—The variation in gyrodynats of the sugars with change in concentration. In all cases where accuracy is desired a double correction is (according to my point of view) necessary; firstly, for the volume of the lead precipitate, and, secondly, for variation in the gyrodynats of the sugars. This second correction is frequently made (*see* Spencer's Handbook for Sugar Manufacturers, p. 300. Geerligs' Methods of Control, p. 9.) In some recent forms of polariscopes this correction is made in the graduation of the scale.

There was no necessity for H. Pellet to remind me of the Clerget process. In my initial communication I was treating of the direct reading only, and indeed the volume of the lead precipitate affects the Clerget process equally as it does the direct reading.

With what H. Pellet has written elsewhere concerning the necessity of using the Clerget process when accuracy is desired I am in complete agreement.

I may finally point out that the method that I adopted for testing the subject of this communication is entirely independent of the exact adjustment of the polariscope to zero and of the accuracy of the scale graduation and of the quartz wedges, since all readings taken for the sake of a comparison are made at almost the same point on the scale. The exactness of the lengths of the polariscope tubes is involved, and this is a point easily controlled.

Noël Deerr.

Postscript.—Since writing the above reply I have read the article by H. and L. Pellet and Ch. Fribourg in the April number of the *Int. Sug. Jour.* dealing with variation in the rotation of the sugars with change in concentration.

I do not think that their calculations, based on the determinations of Tollens, in so far as regards cane sugar, can be pushed so far, as his results differ sufficiently from those of other investigators—Schmitz, Pribram, Nasini, and Villavecchia—to invalidate a too refined calculation (cf. Landholt's Optical Rotation of Organic Substances, Eng. edition, pp. 194-197; 596-598). For instance, Schmitz' results show a *continual* increase in specific rotation with increasing dilution; those of Tollens showing a *maximum* value at a concentration of 18·86% of cane sugar.

The article by Dr. Horne in the present number would seem to conclusively prove that the lead precipitate does not entrain sugar.

The sugar cane crop in the neighbourhood of Malaga, Spain, has been utterly destroyed through the frosts. This is a severe blow as, coming on the top of other agricultural failures in recent seasons, it has quite ruined the country people.

THE IMPROVEMENT OF THE SUGAR CANE BY SELECTION AND HYBRIDIZATION.*

By Sir Daniel Morris, K.C.M.G., and F. A. Stockdale, B.A.

Abridged from the *West Indian Bulletin.*

The discovery that the sugar cane produces fertile seed, from which can be raised seedlings possessing varied characteristics as well as increased richness of juice, has placed cane growers in a position to endeavour to improve their varieties, so as to place the cane in an equally favourable position with the beet.

The attacks of various diseases and the general fall in the price of sugar made it necessary for all cane-growing countries to establish local departments to inquire into the best means of combating these disasters. Owing to the great influence of soil and climatic conditions on the yield of sugar, highly improved methods of cultivation and the use of modern appliances in manufacture, received considerable attention, as being the most direct means of accomplishing a cheaper production. It was, however, found that a hardier race of plants, which would give a greater tonnage of canes to the acre, was the first requisite, the quality of the juice being taken up for improvement later.

Although most of the older varieties of canes were found to suffer from the ravages of insects and disease, and, in consequence, a considerable loss of sugar was experienced, yet no serious steps were taken to inquire into the methods of preventing this loss until, in some instances, total crops had been almost entirely destroyed. Then the minds of a few began to turn to methods of obtaining improved varieties of canes. It became absolutely necessary to produce canes which were more resistant to disease, and at the same time, if possible, varieties which would give a larger yield of sugar per acre. This increased yield of sugar could be obtained in three ways, the combination of all three being the goal aimed at. These were: (*a*) by an increased tonnage of canes per acre; (*b*) by an increased yield of saccharose in the juice, with a higher ratio of purity; (*c*) by a freedom from rotten canes.

The differences apparent in existing varieties made it obvious that it was possible to produce new and improved types superior to those already under cultivation; but, like all plants propagated mainly by cuttings, it was extremely difficult to notice slight variations amongst individual canes. Striking examples of seminal and bud variations had been noticed and some of these had proved of value. The following four methods were those by which variations were utilized to

* This paper was presented to the Conference on Genetics held in London in August, 1906, under the auspices of the Royal Horticultural Society.

improve the quality of the crops: (1) Selection amongst native varieties; (2) Introduction of foreign varieties; (3) Hybridization between native varieties; (4) Hybridization between native and introduced varieties.

Selection.

The chief variations to be looked for amongst existing races of cane may conveniently be classed under three heads: (*a*) Variations in habit and vigour of growth; (*b*) Bud variations; (*c*) Variations in sugar contents of individual canes.

(*a*) *Variations in habit and vigour of growth.*—Amongst a large area of canes of any single variety, there were always to be seen some canes distinguishable by greater size and vigour. Planters were advised to select and cultivate such canes, as their great vigour seemed to indicate a greater power of resisting attacks of disease. This method has been tested practically under scientific supervision in the West Indies, and it has been found that many of the canes thus selected were capable of producing larger yields of sugar. Investigation of the more vigorous canes showed that they frequently varied to a considerable extent from the main crop, and therefore it is quite probable that many of them, instead of being variations of the mother type, were really seedlings which had come up in the fields, and had become cultivated in the next crop. Some of these variations could not be accounted for in any other way, and it was this peculiar appearance of new varieties of canes that subsequently led to the discovery of canes growing from seed.

(*b*) *Bud Variations.*—Bud varieties or *sports* are not uncommon in the sugar cane. In fact, in 1886, a communication was addressed from the Royal Gardens, Kew, to all the sugar-producing colonies to stimulate inquiry into the advisability of searching for and cultivating sports on a large scale, as it was probable that some of these varieties would prove hardier and give a greater amount of sugar than the original stock.

Up to 1901 instances of such variations were recorded from widely separated countries, viz., Mauritius, Louisiana, West Indies, and Queensland. Since then, other bud varieties have been noticed in the West Indies, and quite recently, two interesting accounts of sports have come to hand from Madras and Queensland.

In Queensland, one of the seedling canes has produced a sport which gave an analysis of 19·72 per cent. saccharose, as against 19·03 per cent. saccharose of the parent cane, and 18·97 per cent. of the next best seedling. It would appear that sports generally arise from striped or ribbon canes, and usually keep true to a whole colour; but instances have recently occurred in Barbados in which a green cane has given rise to a green and white striped sport. Clark, Queensland, holds that "yellow sports have a tendency to grow sweeter than the coloured canes of the kindred variety." This is not borne out by the

instance lately recorded from Madras, for a striped cane has been found to sport into red and white canes, and "whereas the white cane gave on analysis very similar results to the parent cane, the red sports excelled all other canes in the station in purity of juice."

In order to put the relative merits of the sport canes and the original stock to a strictly comparative test, they were planted at the Experiment Station, Dodds, Barbados, side by side, in the same field, with other experiment canes, when the yield from the sport cane exceeded the yield from the original stock cane by nearly 2000 lb. of saccharose per acre. This superiority was due to the higher tonnage of the sport canes, their juice being slightly less rich in saccharose, and slightly less pure than the original stock. The juice of both was rich in saccharose.

Without doubt, these bud varieties deserve much more attention than is given to them, both on account of their economic importance, and also because the study of their variations may yield results of scientific and, probably, practical value. As to the cause of the real nature of these bud varieties very little is known at present. It has been suggested that these striped or ribbon canes are the results of cross-fertilization and that, therefore, the sports are to be considered as cases of dissociation and then segregation of hybrid characters, or of *atavism*.

It is supposed that unfavourable influences, either external or internal, temporarily encumber the growth of the young buds and predispose them to reversions. But, if sports are of an atavistic nature and are favoured by influences that impede normal growth, how is it that they, almost without exception, give such excellent results when cultivated, being hardier and richer than the original stock from which they arose?

(c) *Variations in sugar contents of individual canes.*—Bearing in mind the classical experimental work, with which the name of de Vilmorin is associated, in selection of the sugar beet, by which, through the aid of science, the sugar content has been raised from 10 to 18 per cent., workers with sugar cane were led to commence investigations with regard to the chances of obtaining canes of higher saccharine content. The occurrence of a wide range of variation in the percentage of saccharose in the juice of canes of the same age and variety was soon noticed, and the fact that the sugar cane was propagated by cuttings naturally suggested that any improvement inherent in the plant could be developed more rapidly than if it had to be grown from seeds. Investigations in chemical selection have been carried out in the West Indies, but the results so far obtained, are not at all conclusive.

d'Albuquerque, Barbados, at the last West Indian Agricultural Conference, 1905, stated that it would appear "that, with a given variety, the richness or poorness of the seed-cane (*i.e.*, cane used for

planting) does not affect the quality of the juice of the resulting crop." Harrison, British Guiana, concludes that the "relative richness of seedlings is qualitatively, if not quantitatively, constant." Watts, Antigua, however, states that "some difference is induced by the process of selection, and, while this method of work is not likely to be followed by practical planters as a means of improving their canes, yet the fact is interesting from its scientific aspect as indicating that plants propagated by cuttings are subject to slight alterations."

In Queensland it has been stated that improvement from single-stalk selection is not as great as would be expected, while in Java * the evidence seems to point to the fact that selection amongst "cane-clumps" is likely to give better results than selection among individual canes.

INTRODUCTION OF FOREIGN VARIETIES FOR FIELD CROPS.

The introduction and trial of standard varieties of sugar-cane from other countries is of considerable interest to planters, as probably this was the principal means by which the sugar cane was distributed throughout the tropics.

Evidence, on the whole, seems to point to India and Polynesia as the original home of the sugar cane, but it is now cultivated in various localities on both sides of the Equator ranging from the south of Spain, 37° north, to New Zealand, 37° south.

Of the older varieties of cane there appear to have been three or four which were extensively cultivated. In those countries where these are still free from disease, very few others have, as yet, taken their place; but where their cultivation has become impossible on account of the ravages of disease, others have been introduced to take their place.

In the West Indies, the Bourbon and Otaheite canes have almost entirely been replaced by other improved and hardier varieties. In Java, the introduction of the East Indian cane Chunnee was rendered necessary owing to the home cane being very liable to the "sereh" disease.

Within the range of cultivation of the sugar cane there are yet many countries where it might be largely grown if only the prevailing low prices should improve.

With the introduction of imported varieties it should be realized that there is always a danger of introducing new diseases and pests. It is important, therefore, that all imported plants be carefully fumigated and disinfected before being allowed to enter any country. Throughout the West Indies, laws of fumigation and disinfection of all imported cane cuttings are generally enforced, and, now that seedling canes are beginning to play such an important part in the

* For the results of chemical selection investigations by Kobus, in Java, see *I.S.J.*, Vol. VIII., p. 296.

improvement of the sugar cane, and their introduction into new lands is becoming universal, it cannot be too strongly urged that all cane-growing countries should adopt means to prevent the introduction of new pests and diseases.

Hybridization.

In Europe and America, much of the progress of agriculture during the last fifty years has been due to the continual improvement of the cultivated varieties of plants and to the production of new varieties. In the tropics, such work, until lately, has been almost entirely neglected, and therefore a record of practically the first work in this direction should be interesting. Although such work has been possible for eighteen years, it is only within the last decade that systematic attempts have been made to raise seedling sugar canes on a large scale.

(*i.*) Historical.

It would appear that sugar canes, probably produced from seed, were observed at Barbados in 1848 and 1850, and the question respecting the possibility of growing seedling canes in the West Indies was raised at various times between 1859 and 1888. In the latter year, Harrison and Bovell from Barbados communicated to Kew that they had sixty cane plants under cultivation and that they were almost satisfied that they were seedlings. This eventually proved to be so, and from that time systematic attempts to raise new varieties of seedling canes in Barbados, British Guiana, and elsewhere in the West Indies have been undertaken with highly satisfactory results.

A similar announcement as to the possibility of raising seedling sugar canes was made by Soltwedel in Java in 1887.

Previous to 1887 or 1888 it was generally believed that the sugar cane, in common with the banana and other tropical plants, had lost its power of producing fertile seed, and that all recorded observations of new canes up to this time were bud varieties or sports. However, since the establishment of the fact that the cane does produce fertile seed, the improvement of the sugar cane by hybridization has made wonderful strides, and now experiments, conducted on scientific lines, are being carried out in Java, India, Hawaii, Queensland, Cuba, British West Indies, and British Guiana, &c., with the hope of raising canes less susceptible to disease and yielding a larger amount of sugar per acre.

(*ii.*) Methods of obtaining Seedlings.

In some countries the earliest method adopted for obtaining seedling canes was by a collection of fertile seeds or casually produced seedlings from the fields.

A later step was the identity of the seedlings from the seed-bearing parent. This method was the one early adopted by Harrison and Jenman in British Guiana. The cane from which the arrow was

taken was carefully recorded, and thence commenced a stock of new varieties of canes with the parentage known on one side only.

A further stage was the raising of seedlings from two varieties of canes by planting in adjoining rows varieties known to arrow at the same time. By this means there was a possibility that the pollen-bearing parent might be identified as well as the seed-bearing parent.

Thousands of seedlings have been raised by these methods, but, although the seed-bearing parent was known and registered, the pollen-bearing parent was still uncertain. In consequence, a large majority of the seedlings were found to be less valuable than the seed-bearing parent originally selected. In many cases, however, it was evident that the resulting seedling canes were true hybrids. These hybrids, when they possessed a vigorous habit and a high saccharine content, were carefully propagated and subjected to a rigorous system of selection.

The fixing of good varieties was rendered more easy, as plants raised from cuttings come true to the parent forms, and do not necessitate additional selection year after year. After these seedlings have been sufficiently investigated to warrant recommendation to the planters, they were gradually introduced into general cultivation, and have proved the means of overcoming to a considerable extent the ravages of disease, as many were hardier than their parent forms.

Through the uncertainty of the results of the above-mentioned methods of what may be called natural or chance hybridization, it was considered advisable to conduct hybridization under control, and by this means it was hoped to combine some of the desirable characters of both parents, and therefore produce pedigree canes, which could be recommended for general cultivation.

At the second West Indian Agricultural Conference of Barbados in 1900, d'Albuquerque, after discussing methods in securing natural hybrids which, however, did not ensure against the risk of pollen from an unknown source, recommended an artificial method of securing cross-pollination, *e.g.*, " to bag each arrow under experiment some time before it is ripe, and when the arrows in the bags are ripe, to shake the contents of the bags of one variety into the bags covering the arrows of another, the latter bags being temporarily opened at the top to receive the pollen, and then closed up ; every possible precaution being taken to prevent, during the transference, the access of pollen from any other source."

It was, however, pointed out that such a method did not entirely prevent self-pollination, and therefore it has been replaced by others in which the risk is not so great.

In 1894, it was found by Wakker in Java that the Cheribon cane did not bear fertile pollen while the pistil was normal, and therefore any seedlings raised from this cane would be the result of cross-fertilization. This was a great advance in the hybridization problem

of the sugar cane. Kobus, by planting other good varieties known to possess fertile pollen by the side of this Cheribon cane, obtained thousands of seedlings as the result of inter-crossing. Investigations in Java upon the raising of sugar cane seedlings centred around this discovery, and, therefore, in 1902 a large number of the best seedling canes at Barbados were examined by Lewton-Brain in the laboratory of the Imperial Department of Agriculture for the West Indies to inquire into the proportions of fertile to infertile pollen in the anthers of different varieties. By this means it was possible to divide the West Indian varieties of canes into three classes: (1) in which the anthers show a large proportion of normal pollen; (2) in which the anthers show a very small proportion of normal pollen, (3) in which the anthers show a moderate proportion of normal pollen. If, therefore, an arrow of a cane producing much normal pollen is bagged with an arrow of a cane producing little fertile pollen, the risk of self-fertilization is reduced to a minimum, and if fertile seeds are produced by these canes, they will almost certainly be the result of hybridization.

The possibilities of the hybridization of the sugar cane under control, by removing the stamens of one flower and the transference of pollen from another, were discussed by Boname, Mauritius, in 1899. It was thought, however, that this was almost impracticable on account of the large number of flowers on each panicle, and also their microscopic size. It was also pointed out that it was not known, with certainty, whether the flowers of the sugar cane were autogamous or not, and, therefore, emasculation would have to take place while the flowers were very young. The emasculation of immature spikelets of the sugar cane without injuring the very delicate ovary and stigmatic plumes was thought to be an operation of considerable difficulty, and, therefore, the raising of seedlings by hybridization under control was dismissed as being impossible. In 1900, d'Albuquerque stated that, to ensure that the seedling canes produced are the result of cross-fertilization between the parents selected "would need the elimination of the anthers before they were mature—a very difficult task in a plant, the parts of whose flowers are so small as in the sugar cane;" but in 1904, Lewton-Brain, after consultation with d'Albuquerque and Bovell, performed experiments in artificial cross-pollination, in which the flowers of one variety were emasculated while still young, covered in a muslin bag, and then pollen from another variety was transferred to them by hand. This method of raising hybrids by artificial cross-pollination proved successful. Five stools of hybrid canes were raised in Barbados as the result of this work. It is reported that four pedigree hybrids have been raised in Queensland, and in Cuba about 600 are said to be now under investigation.

The operation of emasculating the flowers has to be performed under a dissecting microscope upon a platform 8 or 9 feet above the

ground. Such an operation under field conditions with a strong wind blowing is attended with considerable difficulty. Even when accomplished, an unfavourable season with very hot dry winds or heavy rains is likely to destroy the chance of good results. That so much depends upon the season may be seen by the results from Cuba. Four years' work yielded but two hybrid seedlings, while the work of a single favourable season produced 600.

(*iii.*) OUTLINES FOR FUTURE WORK.

Formerly, with a nearly common standard of perfection, the attempts to procure an improved race of sugar canes centred around breeding from the best varieties; but now, by carefully analyzing the different characters of the different varieties under cultivation, it may be possible to breed methodically for definite objects.

The first thing to consider, therefore, is what desirable characters are required to be chosen. As it is necessary that the hybrids should be an improvement commercially, only those characteristics of the cane which appeal to the planter should be considered. The chief amongst these are:—

> (1) Behaviour under extreme conditions of drought or excessive moisture. (2) Maturity—whether early or late. (3) Disease-resisting power. (4) Milling qualities. (5) Tonnage of canes per acre. (6) Richness of juice in saccharose. (7) Purity of juice.

It would be impossible at the outset to consider all these characters and, consequently, it would be advisable to work with those which are of greatest value economically.

The essential characters to be considered are resistance to drought, resistance to disease, a larger tonnage of cane per acre, richness of juice in saccharose, and, in some of the northernmost countries, early maturity. As a result of the previous work done in breeding sugar canes, it is now obvious, that a class of canes has been produced that possess, to a large extent, qualities which enable them to resist certain classes of disease. More, however, requires to be done in this direction, for the root disease, for instance, is one which does a considerable amount of damage in the West Indies, Hawaii, and elsewhere. In Java, it is held that a larger yield of sugar depends upon the cane possessing an increased vigour, and also greatly upon immunity from disease, and therefore breeding for resistance to disease (the root disease in particular) is one of the first points to be aimed at.

The tonnage of cane per acre is specially a point of great importance. In 1902, Harrison reports that "the results confirm those of previous experiments, that neither the addition of phosphoric acid, of potash, or of lime to the manures favourably affects the sugar contents of the juice of the canes. The effects of nitrogenous manurings appear to be somewhat to retard the maturation of the canes, and thus the juice of canes manured with them is as a rule not so rich

in saccharose as is that of canes grown without manure. But this effect is far more than off-set by the larger yields of produce resulting from the application of nitrogenous manures, and to the fact that the increases produced by the nitrogen are principally due to the development of the stalks in length and in bulk, and not to abnormal increases in the amounts of tops and leaves or the production of new shoots to the stool." Watts and Cousins have shown that different manures influence greatly the yield of cane per acre without appreciably altering the saccharine richness of the juice. Moreover, Cousins, Jamaica, holds that "beyond a certain point—24 per cent. saccharose in the juice—any increase in richness involves a reduction in agricultural yield." He also believes that "the line of development of the sugar cane as a cultivated plant, lies primarily in the direction of increased tonnage of cane, and secondarily, in that of greater purity of juice."

As only a few of the varieties now under experiment possess over 20 per cent. saccharose in the juice, maximum productiveness has not been obtained; but nevertheless, it would appear that disease resistance and a larger tonnage of cane per acre, both of which depend largely upon increased vigour of the cane, should receive first attention.

Once having obtained the desired type of seedling, it will be easy to multiply it to any extent without the necessity of fixing the type by further breeding, as the sugar cane on a large scale is propagated by cuttings and not by seed.

(*iv.*) Classification and an Appeal for Uniformity.

Most of the older writers classified canes according to the countries of their origin; in many cases their true origin was unknown and, therefore, new names were provided. Subsequently, local names were assigned to the same variety, and shortly a confusing number of synonyms was established. In 1890, Harrison and Jenman recorded that, in their collection of the world's canes on the Experiment Stations in British Guiana, the *Bourbon* cane (one of the oldest varieties) was represented under six distinct names, and the *White Transparent* under four.

They therefore suggested that a system of classification should be universally devised, and finally concluded that the best and easiest method was to arrange them in groups according to their outward characters.

Five classes were formed:—

(1) Yellowish green or green, often blotched with red.
(2) White, vinous, or brown-tinged canes.
(3) Grey or pink-tinged canes.
(4) Ribbon or striped canes.
(5) Claret or purple canes.

Stubbs in Louisiana, however, recognizes only three classes in distinction to the five of Harrison and Jenman, viz. :—

(1) White, yellow, or green canes.
(2) Striped canes.
(3) Solid colours other than in (1).

In comparing these two independent classifications and looking at the synonyms established, it is seen that differences occur, but they show fairly conclusively that the older cultivated varieties of sugar cane were few in number, and presented only those differences which were due to changes of cultivation, climate, and environment.

Since the advent of seedling canes it has become customary to designate their origin by the initial letter of the name of country in which they were originally raised, with an affixed number, *e.g.*, B. 147, (Barbados Number 147), D. 95, (Demerara Number 95), T. 24, (Trinidad Number 24), J. 30, (Jamaica Number 30), &c. Seeing, therefore, that the hybridization of the sugar cane is now becoming general all over the tropics, it is essential that some scheme for naming and classification be devised, or else a greater confusion than ever will be the result. All workers, therefore, in the production of seedling canes should see that a letter and a number be affixed to the new seedlings before distribution, and a system of classification based on colour and other external appearances be adopted.

If such or any other system were uniformly adopted, it would be easy to compare the results of a given variety when grown under different conditions and in different parts of the world.

(To be continued.)

SHARE SYSTEM IN CANE CULTIVATION IN FIJI, HAWAII, AND MAURITIUS.

The following notes from the pen of Sir Henry M. Jackson, K.C.M.G., on the subject of the Share System in Cane Cultivation as adopted in Fiji, Hawaii, and Mauritius, are reproduced from the *West Indian Bulletin*, in the hope that they will be found of some interest to our readers :—

In the recent exhaustive inquiry held into the condition of the labour supply in Trinidad, it was made abundantly clear that the scarcity of labour pressed most heavily on the sugar industry, and that it was largely due to the fact that the overwhelming majority of indentured immigrants left the estates immediately on expiration of their term of service, and their labour was no longer available.

It was pointed out that the East Indians have been described as the "most conservative peasantry on the earth," and that if some means could be devised of offering them comfort and independence

in the district, where for five years past they had been forming many ties, it would probably afford a cheap and permanent remedy, by inducing them to remain on the estate. It is not to be expected of any free labourer, whatever his origin, that he will be content to continue working on the same terms as when under indenture, when there are so many openings for a more independent life and more prosperous occupation; but if he can find on the estates the means of making as much as he can elsewhere, and of leading his own life, it would be natural to him to remain among his friends. It is with the object of showing how these means have been devised and successfully worked elsewhere, that the writer submits the following notes on the share system, worked by means of cane companies in Hawaii, Mauritius, and Fiji.

In Hawaii, the Commissioners of labour reported that in 1902 there was only one plantation on which the system had not been adopted, but that that estate was close to a large town and enjoyed special advantages in the way of local labour. It is true that the imported labour in Hawaii is Japanese, and that these men form the cane companies, but in Mauritius the conditions closely resemble those of Trinidad, and in Fiji the labour on the sugar plantations is almost exclusively Indian coolie immigration.

In Mauritius, at the commencement, considerable outcry was made by some planters when the land owned by others was first offered in small blocks to the coolies; but later many who had at first opposed the system, similarly offered their land, having recognized the great benefit to them of the change. The system was found on experience to lessen the annually recurrent heavy outlay for the introduction of new labour, besides cheapening the cost of the cane supplies, and ensuring the settlement in the vicinity of the mills of considerable numbers of free coolies, from whose ranks could be obtained contracting gangs for some of the harvesting and other work to be done during the crushing season, which work, if performed wholly by indentured labour, as formerly, necessitated the maintenance during the whole year of the maximum requirements of labour during any portion of the year, with the result that the cost of the crops was unduly burdened.

In Fiji, there was also considerable opposition at first among the managers of estates, and as the success of such innovations is largely dependent on the active sympathy of those entrusted with the administration of the details, the earlier results were somewhat disappointing. The proprietors were, however, convinced that the distrust could only be based on the absence of knowledge as to the actual effects, and insisted on the system being given a fair trial, with the result that it was found that the trouble was more apparent than real, and that the greater supervision as compared with the ordinary plantation duties

of the overseers, which the work under the "share system" required at the outset, rapidly became counterbalanced by the spontaneity of the work done, and by there being no need to measure up the individual tasks in each instance daily. The preliminaries, no doubt, necessitate a good deal of additional trouble, but the extra work is fully repaid by the sensible reduction in the cultivation expenses.

The "share system" consists of the division of the land to be cultivated into blocks, a convenient size for which was found to be 60 acres. The land is prepared and planted by the estate, and the blocks are then handed over to cane companies, which may be composed of either free or indentured labourers, or both, and which carry on the cultivation under the supervision of the estate management. Until the cane is harvested the members of the cane company receive an advance of 1s. a day for each day of nine hours worked by such members, such payments being afterwards deducted from the price paid for the cane. When the canes are cut and taken to the mill, the cane company is credited with the amount per ton agreed upon beforehand, and from this is deducted the advances made during cultivation, and the cost of any work done by the estate after handing over.

Appended are copies of the actual accounts of a cane company working a block of 60 acres on an estate in Fiji.

	£	s.	d.	£	s.	d.
The block yielded 1843 tons of cane, which, at 4s. a ton, gave the cane company a return of	....			368	12	0
From which was deducted advances made for days worked	141	19	11			
Cost of stripping and loading (by estate).	8	18	11			
Hired labour for cutting (advanced cane company)..	66	0	0			
				216	18	10
				£151	13	2

There thus remained a balance of £151 13s. 2d., to be paid to the cane company, the members of which had worked approximately 2595 days. This is equivalent to a bonus of 1s. 2d. a day, in addition to the 1s. a day already advanced, making their total earning 2s. 2d. a day. The block was not a specially good one, as on the same estate some cane companies earned as much as 3s. a head per diem, and in no case did they earn less than 2s.

Appendix B gives the actual cost to the estate of the canes of that block delivered at the mill, which is shown as 7s. per ton, including the cost of preparing and planting before the cane company took over

the block, and of the laying of the portable tram line and of all the transport. It also includes a charge of 30s. per acre for supervision and maintenance, and a charge of 5d. per head per day worked for introduction and hospital expenses, though the actual cost of these was only 4d. per unit. It will be noticed that this is charged on the members of the cane company as well as on the estate coolies, and this is due to the fact that the whole of the members of No. 8 company, whose accounts are given, happened to be still under indenture.

Conditions are agreed to by the cane company, under clauses 1 and 7, by which a habitual idler could be got rid of, for not doing his work "satisfactorily and in the manner directed."

The money paid to the cane company, which, in case of the company shown in Appendix A, amounted to 2s. 2d. per head per day for 216 working days, must not be taken as representing the whole of their earning, as all the members had opportunity of gaining money in other ways. In fact, one of the problems to be solved, in order to make the system a success, is how to provide constant employment for the members of cane companies, whose work on their block does not fill their whole time.

In the crop season there is no difficulty, as the members of the cane companies are also employed in the mills, and form part of the cutting gangs.

In order to set the men free for these purposes, the harvesting of the crop grown by the cane companies should be done by gangs of harvesters from amongst the members of these companies, who, under the direction of the estate management, cut and relieve the blocks in rotation desired at a fixed rate per ton. This provides attractive earnings at work near at hand for the members of the cane companies, and as each cutter, or pair of cutters—for they usually work in pairs—is paid according to the tonnage of each truck, the men of the gang are as much on individual task work as when doing similar work under indenture. When the labour of any of these men is required on their own blocks, it is found easy to allow them to drop out for a few days without prejudice to the general interests.

Out of crop time many of those engaged in farming blocks devote a portion of their time to raising other crops on waste lands allowed them by the estate. A further means of overcoming the difficulty of providing the members of the cane companies with constant employment, and especially those still under indenture, who have a right to demand it, is by allowing each company to take up two or three blocks, on which the operations requiring manual labour would be performed at different times, say, a block of early plants requiring much hand work, with a couple of blocks of ratoons cut early in the season. At odd times work may be found in connection with the

maintenance of tramlines, roads, formation and cleaning of drains, and permanent improvements.

In the Hawaiian agreements it is stipulated in almost every case that, when the estate is in need of labour, the cane companies shall furnish as many men as the estate may consider can be spared without prejudice to the cane companies' crops, such extra service being, of course, specially paid for.

In Fiji, the indentured labour readily came forward to work on the system outlined. At first, permission was only granted to those in their last six months of indenture, but it was very soon found desirable to extend it, as it became apparent that the indentured coolies working under the "share system" were beginning to understand the advantages of growing canes for sale to the estates. Such experience is wholly absent from their ordinary conditions under indenture, and it appears reasonable to assume that when such coolies become free they will be more likely to continue to supply the estate than those who have worked under the much less heartening conditions of indentured service for five years, at their release from which, the sudden feeling of freedom is found to cause many to seek other pursuits locally, or decide to return to India.

It was universally admitted by those in charge of estates where the share system has been successfully established, that the canes were better tended than when the work formed portion of the daily task under indenture, and one of the principal managers in Fiji, a gentleman of lifelong experience among indentured labour in British Guiana, Australia, and the Pacific, was able to report in 1900 that the coolies working under the share system were doing double the task per day that any indentured man ever attempts to perform. A very practical result on the estates under his supervision was that in two years' time, although cultivation had increased, the percentage of indentured labour had decreased by almost 10 per cent., and this although the application of the system was still partial.

The writer feels very deeply his lack of anything approaching expert knowledge of the subject treated on, but the sugar industry in general, and indentured labour employed thereon in particular, have always been of special interest to him, and for some years he has been afforded exceptional opportunities of examining the difficulties which hamper them. These notes, which are the outcome partly of personal observation, and partly of discussion and correspondence with men who have faced and overcome these difficulties, are submitted in the hope that they may assist those with a better knowledge of local conditions, in adapting to those conditions a system which seems to go far to meet the advice given to the Labour Committee by a planter of large experience when he said, "make a sort of friend of the immigrant so that when he has finished his time he will stick to the estate and not migrate."

APPENDIX A.

	£ s. d.	£ s. d.
Profit made by Planting Company:—		
1843 tons of cane at 4s.	....	368 12 0
Work done by mill:—		
Stripping and loading	8 18 11	
Work done by Planting Co.:—		
Hired labour for cutting	66 0 0	
Wages paid	141 19 11	
		216 18 10
Profit		£151 13 2

Approximate number of days worked, 2595=1s. 2d. per day bonus; 1s. per day also paid for each day worked, thus making the total earnings of each member of planting company 2s. 2d. per day.

Blocks Nos. consist of 60 acres—30·7 tons per acre.

August 22, 1903.

APPENDIX B.

Planting Company No. Block No. (12 indentured men).

Cost of work done before planting company took over the fields, and of portable tramline and transport:—

	Units.	£	s.	d.
Ploughing out	183	5	2	9
Harrowing	27	1	4	0
Ridging	139	9	8	3
Drilling	24	1	14	0
Replanting	191	18	8	9
Scarifying	103	5	1	0
Ploughing between cane	39	2	12	6
Laying by	14	1	7	9
Portable tramline and transport	102	5	2	0
Scoops	144	6	12	0
	866	56	13	0
866 coolie units at 5d.		18	0	10
Live-stock Units Supervision, Maintenance, &c.:—				
289 Horse units at 1s. 7¼d.		23	18	0
466 Mule units at 1s. 0¾d.		24	15	1
898 Bullock units at 2½d.		9	7	1
Supervision, maintenance, &c., 60 acres at 30s.		90	0	0
2595 Indentured units of planting company, at 5d.		54	1	3
1843 tons cane at 4s. per ton		368	7	3
		£645	7	3

Total cost of cane, £645 7s. 3d.; tons cut—1843—7s. per ton.

THE USE OF LIME IN AGRICULTURE.

By "liming" is understood the application to the soil of lime in the form of burnt lime, either powdered or freshly slaked. In some cases the application of chalk or of so-called "mild" or "agricultural" lime, which are all forms of carbonate of lime, is beneficial, but their action is somewhat different in character to that of burnt lime.

There are few soils which will not derive benefit from the application of lime, even when this substance is present in fair proportion in the soil. A. D. Hall, Director of the Rothamstead Station, states that English experience shows that soils containing less than 1 per cent. of carbonate of lime require liming. This represents about ½ per cent. lime, and there are not a great number of soils in New South Wales which contain as much as this, whereas the bulk of the soils contain considerably less. Liming is beneficial on a great variety of soils, and is to be regarded rather as a means of improving the land than as a direct plant-food. The soils on which it is particularly beneficial are the following :—

1. Soils deficient in lime.

2. Sour soils, on which it acts as a sweetening agent, neutralizing the soil-acidity. On land which is newly opened up, or land which is being reclaimed from swamps, the addition of lime is an essential.

3. On stiff clay soils. The action of lime on this class of soils is to lighten them and render them more friable and amenable to tillage operations.

4. On sandy soils, lime acts in an opposite manner, as will be shortly explained, consolidating them and increasing the cohesive and capillary power of the soil.

5. On land which is destined for leguminous crops, or such crops as are specially benefited by the presence of lime, such as sugar cane, maize, &c. Where a green crop is sown to be ploughed under (green manuring) the previous application of lime to the soil is of the greatest benefit in promoting the growth of the green crop.

Nature of Lime.

Burnt-lime, stone-lime, or quicklime is obtained by burning limestone (carbonate of lime) in kilns of special construction. In the process of burning or calcining, carbonic acid and water are driven off, and the burnt product is pure lime (calcium oxide) of greater or less purity according to the purity of the original stone. Other substances, having the same composition as limestone, also yield lime on being burnt, such as chalk, marble, shells, &c. If the lime has been properly burnt it forms a very hard, stony substance,

nearly white, which slakes, or combines with water, with great avidity, crumbling to a fine white powder, and evolving sufficient heat to convert a part of the water into steam. In slaking, it combines with water, slaked lime being a hydrate of lime. As its function in the soil is principally mechanical, a test of its goodness lies in the readiness and completeness with which it slakes. Both under-burnt and over-burnt lime slake badly, though from different causes.

When liming is recommended for a soil it is always burnt-lime, either powdered or freshly slaked, that is intended. Many substances used as manures contain lime, but in these cases the lime is in combination with other substances and has not the same action on the soil as burnt-lime. For example, bone-dust and superphosphate both contain considerable proportions of lime in combination with phosphoric acid as phosphate of lime. Neither of these substances, however, have any effect in lightening clay soils, or in sweetening sour ones. In the same way chalk or "mild lime" (carbonate of lime) and gypsum (sulphate of lime) are all substances rich in lime, and valuable additions to the land in certain cases, but their action is not that of burnt-lime and they are not to be used when liming is recommended. Wood-ashes also contain carbonate of lime and have also a considerable value as fertilizers. Thomas' phosphate contains free lime, and there is no doubt that it has a considerable effect in altering the texture of heavy clay-soils, but none of these substances are to be substituted for burnt-lime.

Action of Lime on Different Soils.

The action of lime in the first place is a mechanical one, in altering the texture of the soil, and with it those properties which depend upon its texture, such as its absorptive power for water, its amenability to tillage operations, &c. The action of lime upon a clay soil may be illustrated by the following experiment:—If a small quantity of a heavy clay be mixed with water in any suitable vessel, it will form a muddy liquid. If a little lime be added to this, and the mixture well shaken, it will be noticed that the solid matters sink to the bottom in a loose powder, and in a short space of time, if the water is poured off and the soil dried, it can be readily broken up by the fingers. If no lime had been previously added, the clay, on drying, would form a hard mass, difficult to break up. This action, which is due to the power that the lime has of coagulating the fine particles of the clay, is identical with what takes place on the larger scale when lime is added to the field.

The presence of lime also prevents the shrinkage which wet clay soils undergo on drying, and which causes the cracks and fissures seen on the parched clay-soil. The admixture of lime to a clay, therefore, prevents the formation of a sticky mass when wet, and a cracked, parched appearance when dry.

Limed land is drier and warmer, more friable, and consequently more readily cultivated. Land which has been limed is ready for the plough sooner than unlimed land.

On light, sandy soils the action of lime is also strikingly beneficial in binding the particles of sand together, and increasing the cohesive and capillary power of the soil. Its action is, in fact, exactly that of lime on sand in the mixing of mortars, only on a much modified scale, since for making mortar the proportions are one part of lime to three or four parts of sand, whereas the addition of a ton of lime per acre represents one part of lime to nearly 20,000 parts of sand. The action of the lime is the same in both cases—on drying it absorbs carbonic acid from the air, forming carbonate of lime, which cements the particles of sand together; forming, in the proportions used in making mortar, a hard compact mass, and, in the case of the soil, increasing its cohesiveness and its power of retaining water.

Lime, therefore, lessens the cohesiveness of clay soils, and increases that of sandy soils—two properties which are apparently opposed to one another; in fact, there are few soils the mechanical texture of which is not improved by liming.

The action of slaked lime is exactly the same as that of stone or quicklime, but not so pronounced, and it is generally preferable to use the lime unslaked, or only slightly and freshly slaked.

Chemical Action of Lime.

Apart from the above mechanical property of lime in improving the texture of the soil, it has also a chemical action, and though this is not thoroughly understood, it may be classed under the following headings:—

Firstly, it neutralizes the acids sometimes present in soil. Sour soils contain free acids present in such quantities as to be injurious to plant life, and such soils are "sweetened" by the application of lime—that is to say, the free humic and similar acids are neutralized.

Secondly, it attacks the inert organic matters in the soil and promotes fermentation—one of the most active agents in the production of available plant-food. It is, of course, possible to have too much of a good thing, and an excessive dressing of lime would tend to burn up the vegetable matter of the soil, and do as much harm as good; but in the moderate dressings recommended, it will be found beneficial even on land which has lately been green-manured. It must not be forgotten, however, that the action due to caustic lime soon ceases, for it is very rapidly converted into carbonate of lime within the soil, which has no such action on organic matter.

Thirdly, it attacks the insoluble mineral constituents of the soil to some extent. This is notably the case with potash, which is set free from its insoluble compounds, such as felspar, and rendered available as plant-food. Phosphoric acid also enters into combination with

lime, and is, in this form, more readily utilized by the plant than in its insoluble combinations with iron and alumina, with which it is associated in the soil. Owing to the tendency of lime to burn up a portion of the organic matter, its benefit is more marked on soils rich in organic matter.

Fourthly, carbonate of lime (into which we have seen the lime is soon converted in the soil) is beneficial, if not necessary, to the process of nitrification, the peculiar ferment action by which the inert soil-nitrogen is converted into nitrates.

Fifthly, whilst its promotes certain ferment action, such as the above, it hinders the active growth of many fungoid diseases like rust and smut, and is said to be often a cure for such diseases.

Methods of Application.

Lime may be applied in two ways—either as ground lime or freshly slaked. As ground burnt-lime it is applied at the rate of 5 to 6 cwt. per acre in a manure-distributor and lightly scattered over the surface. If freshly-slaked lime is used it is applied in somewhat larger quantities up to ½ ton per acre, or even more in the case of very stiff clays. The heavy dressings once employed are found to be less beneficial than smaller applications more frequently applied.

Liming with freshly-slaked lime is best carried out as follows: The quicklime (stone-lime) is broken up into smaller lumps and placed in heaps about the field covered with moist loam. It is left exposed to the air and moisture until it begins to crumble to powder. As soon as this happens the heaps are scattered with a shovel as evenly as possible oven the surface of the field, and harrowed or ploughed in very lightly. Liming is most effectively done in the autumn or winter, but whenever it is done the land should be left alone for two or three weeks after the application, and no seed sown nor any manures (especially such as contained nitrogen or superphosphate) used during that period.

Other Lime Compounds.

Carbonate of lime is used in several forms—such as chalk, unburned limestone or shells, and "mild" or "agricultural" lime, which latter is old burnt lime which has been exposed to the air and become converted into carbonate by absorption of carbonic acid. Its addition to the soil promotes nitrification, sweetens sour soils, and prevents clay soils from puddling, though it is less powerful in the latter respect than burnt lime. It is milder in its action and, as a rule, burnt lime is to be preferred.

Gypsum or plaster (sulphate of lime) may also be sometimes used to advantage. Its action, apart from its action as a direct plant-food on soil poor in lime, appears to consist in setting potash free from its insoluble combinations in the soil, hence it is most useful on soils rich in potash, and for such crops as clover it is of especial service. It is best applied moist or in wet weather at the rate of 2 to 3 cwt. per

acre. Gypsum is also often used as a "fixer"—that is to say, when added to dung or urine or decaying animal and vegetable matter, it decomposes the carbonate of ammonia which is being continually evolved from such substances and converts it into sulphate of ammonia, in which form ammonia does not escape into the air. If a heap of dung, from which the odour of ammonia is perceptible, be mixed with a few shovelsful of moist gypsum, the smell will be found to have disappeared—in other words, the ammonia is "fixed," and its loss prevented.

Gypsum is also of great value in lands which are charged with alkali, or irrigated by alkaline water. For this purpose it is either strewn on the land in proportions depending upon the amount of alkali in the soil, or it may be introduced in boxes in the irrigation sluices, or added to the tanks if the water is stored.—(F. B. Guthrie in *N.S.W. Agricultural Gazette.*)

THE COMPOSITION OF REFINED* SUGAR.

By H. Pellet.

(Translated from "Bulletin de l'Association des Chimistes.")

Refined sugars may be divided into three classes:—

(1.) Those obtained as first jet.

(2.) Those obtained during the subsequent treatment of the molasses and which are either centrifugalled and bagged off, or are partially centrifugalled and re-dissolved in the sucrerie itself.

(3.) Raw sugars obtained from crystallizing tanks.

Formerly there were produced:—

(1.) First jet sugar, which was either white (No. 3) or fairly well refined.

(2.) Second jet sugars, resulting from the slow crystallization of second masse-cuites in tanks.

(3.) Third jet sugars obtained from third masse-cuites, after they had been left in the crystallizing tanks for several months.

(4.) Sometimes a fourth jet sugar, which was cured a few days before the new campaign commenced.

Finally, in certain sucreries and countries, additional grades of sugars were obtained by osmosis, applied once or several times, and giving a total of from seven to nine distinct grades of refined sugar.

To-day, the ideal is to exhaust the molasses as rapidly as possible by means of new processes for treating the masse-cuites. On the other hand, the practice in several sucreries is merely to suppress the second, or intermediate, jet so as to obtain a white (or fairly clean) first jet, and to recover the remainder of the sugar after the molasses

* The term "Sucres Roux" has no exact English equivalent, but refers to all refined sugars which are not classed as "white sugars" in the Paris market.

have been re-boiled and left in the crystallizing tanks for several months.

Each general mode of working being subject to many modifications, it is very difficult to describe the processes now used for obtaining, as rapidly as possible, sugars of high purity and well exhausted molasses.

As regards the composition of these sugars, we will commence with class (1), consisting of first jet crystals.

The composition varies according to the conditions under which the sugar is cured and also to the quality of sugar made. The percentage of moisture varies from 0·20 to 1·50; and the percentage of ash from 0·20 to 0·70 or even higher.

Of more special interest is the percentage of organic impurities; and from the analysis of several thousand samples we are able to assert that the ratio of organic impurities to mineral impurities is the same in the sugars as in the masse-cuites from which the sugars are derived. We here refer to soluble impurities only and assume that the masse-cuites are derived from syrups which have been efficiently filtered. It has also been proved some years ago that the ratio of the so-called "soluble ash" to total ash is practically the same for similar samples. Consequently, when this ratio of mineral impurities to organic impurities has once been determined, together with the percentages of moisture and of total ash, it appears possible to analyse the sugars without resorting to the polariscope.

Experiment has confirmed this view. But as the ratio varies in different sucreries in different years, and also when the low grade sugars are re-dissolved in the juice, it can only serve as an occasional check on the direct polarization.

The composition of sugars belonging to class (2) is essentially different. They contain from 3·50 to 3·90 % of ash, which indicates that the crystals retain from 35 to 40 % of molasses which is returned to the factory when the sugar is re-dissolved.

The ratio of organic to mineral impurities in these sugars is also approximately identical to the same ratio in the masse-cuites from which they are cured, but sometimes differs owing to the crystallization of salts along with the sugar. For example, if the ratio be 1·60 in the masse-cuite, the ratio may fall to 1·5 or 1·4 in the cured sugar, whilst the ratio in the molasses will rise proportionally.

When the low-grade sugars are re-dissolved in the juice, the ratio of organic to mineral impurities in the masse-cuite is modified. Nevertheless, masse-cuites of good quality and well crystallized will yield sugars containing only from 0·54 to 0·70 % of ash, and that without increasing the purity of the resulting molasses.

In order to determine the conditions under which a sugar of a given quality may be obtained in the shortest possible time, the working up of the masse-cuites must be continuously controlled by the chemist.

Nor is it sufficient for this purpose to analyse an occasional sample of molasses, as is done in many usines, for want of assistants or apparatus in the laboratory. The chemical control must be serious and thorough.

When the ratio of organic to mineral impurities is found to fall during the crystallization of the masse-cuites, the composition of the ash varies, and a certain quantity of sulphates crystallize out with the sugar. Such sulphates are due to the sulphuric acid normally present in the juice and masse-cuite, and an additional quantity formed during the sulphitation of the juice and syrups.

The sulphites, which are formed during sulphitation or when bisulphite of soda, or similar agents, are used instead of the gas, are readily converted into sulphates which tend to crystallize along with the sugar, and are thus separated from the molasses. The cured sugar retains these sulphates in varying quantities, according to the rapidity of the crystallization, the mode of curing, &c., so that an analysis of the ash will frequently reveal an abnormal proportion of sulphates.

So also in sugars of Class 3 the composition of the non-sugars depends on the following factors:—The rapidity of the crystallization, whether this takes place at rest or in motion; whether at a high or at a low temperature. Also the capacity of the crystallizing tank, and whether this is heated or cooled intermittently. Finally, the mode in which the masse-cuite is prepared for curing, and the mode in which it is cured. If, further, these sugars differ in quality, the percentage of ash may vary between 1·50 and 2·00 %.

As regards the ratio of organic to mineral impurities, this, also, must necessarily be subject to fluctuation, as is seen in the following examples.

In some analyses made in the same year, and by the same chemist, and in which the percentage of ash varied from 1·10 to 1·90, the above ratio was 1·70 in the molasses and from 0·75 to 2·17 in the cured sugar. During another campaign the cured sugar contained from 1·15 to 2·50 % of ash, the ratio varying from 1·10 to 1·85. During another year the sugar contained 0·84 to 1·80 % of ash, and the ratio varied from 1·20 to 2·16. Finally, in another case, the sugar contained from 1·50 to 2·70 % of ash, and the ratio varied from 0·80 to 1·40.

One of these samples of sugar gave the following analytical figures:—

Water	2·92
Ash	2·62
Sugar	92·00
Organic Impurities	2·46
	100·00

Ratio of organic to mineral impurities = 0·93.

The same ratio in the masse-cuite being 1·61, it became evident that some salts had crystallized out with the sugar. On analysing the ashes the following figures were obtained:—

	Molasses Ash. Per cent.		Sugar Ash. Per cent.
Chloride of Potassium	8·3	..	4·3
Sulphate of Potassium	25·0	..	62·0

This indicates that at least 1·20 parts of crystallized sulphate of potassium were present per 100 parts of sugar crystals; so that if the former were absent the percentage of ash in the sugar crystals would have been only 1·40 or 1·50.

This simultaneous crystallization of mineral salts and of sugar is not a recent discovery. Formerly, before the sulphitation process was much used, the salts which crystallized out with the sugar, were the chlorides and nitrates, especially when the roots were poor and grown on over-manured land which had been sown with inferior seed. At that time, also, the intermediate products were not so efficiently filtered as to-day and, consequently, the sugars retained a good deal of insoluble matter, and this necessitated the determination of the "soluble" ash by the Excise.

At one time it was supposed that the organic non-sugars amounted to four-fifths the weight of the ash, and sugars were even analysed on this basis. Although it might hold true in some cases, it was more often inexact, as was proved 35 years ago by Woussen. The following is an example:—

	2nd jet Sugar	
	Actual Analysis	Analysis based on ⅘ ratio
Polarization	93·600	95·059
Water	2·020	2·020
Ash	1·456	1·456
Undetermined	2·924	1·465
	100·000	100·000
Yield (for co-efficient 5)	86·32	87·77

The polarization of 95·059 would be usually reported as either 95·0 or 95·1; the "undetermined impurities" being then filled in by difference.

I may mention that I have been occupied in sugar analysis since 1867, at which time one of the first public laboratories for the analysis of sugars was established in Paris under the direction of Zalinski. I was then second assistant to M. Payen in the laboratory of the Conservatoire des Arts et Métiers, M. P. Champion being the chief assistant.

From the sugar analyses made by M. Woussen and ourselves during the control of the manufacture during 1874, it is evident that the ratio of organic to mineral impurities in the second and third jet sugars varied from 0·5 to 2·0 according to circumstances.

CONSULAR REPORTS.

THE AZORES.

In 1906 sugar was imported to the value of £5,383, the largest importation being from Germany and the United States; the values were £2,211 and £1,794 respectively, the United Kingdom taking the third place with £922. From Brazil St. Michael's took sugar to the value of £456. Trifling amounts were obtained from the Argentine Republic, Belgium, Denmark, and the Netherlands.

MEXICO.

The increases in Mexican exports for the year 1905-06 are practically nullified by the almost complete extinction of the export of sugar during that period. From £571,744 the value has fallen to £67,423. The home domestic demand, however, improved sufficiently to keep the prices of sugar at a reasonable figure.

Export of Manufactured Sugar.

Year.	Sugar. Metric tons.	Coarse Sugar. Metric tons.
1901-02	2	147
1902-03	8,003	255
1903-04	16,313	177
1904-05	38,701	569
1905-06	5,076	122

SUDAN.

The values of the sugar imported into the Sudan *via* Suakin the last two years have been as follows:—

1905.	1906.
£8,829	£16,775.

It all went to Khartoum.

Besides the above, sugar to the value of £8,760 was imported *via* Port Sudan on the Red Sea. Of this about 25% came from Austria-Hungary, the rest from Egypt.

It should be noted that the goods coming from Egypt are not all of Egyptian origin. There is no fiscal barrier between Egypt and the Sudan, and articles which have paid duty in Egypt are admitted free into the Sudan (under "Ilmukhaber"). One result of this system is to give a material advantage to the import of Egyptian sugar.

The new cane harvest in Queensland will establish a record, it is said, as its value will reach two millions sterling. The labour supply is, however, considered totally inadequate, and steps will have to be taken to get additional help.

PUBLICATIONS RECEIVED.

Die Marmeladenfabrikation nach Englischen Verfahren (English Methods of Marmalade Manufacture), by Conrad Rapp. With 44 illustrations. Schallehn & Wollbruck, Magdeburg. Paper covers, Mks. 4·50; bound in cloth, Mks. 5.

This book is well written, and in the hands of a practical man should enable the German workman to make jams and marmalade similar to those used in England. The article on machinery shows the author's intimate knowledge of the most up-to-date machines, and the illustrations easily enable the reader to clearly follow the ideas. The chapter on the use of glucose shows a practical knowledge of the subject, and explains, in a most lucid manner, the reasons for using American glucose, and shows how anyone using this product is handicapped by the high tariff erected by the German Government. We recommend anyone interested in the manufacture of jams and marmalade to obtain a copy of this work, and they will be well rewarded by the amount of useful information they will obtain from it.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Abridgment.

12950. T. B. Wagner, Chicago, Illinois, U.S.A. *Improved process of manufacturing anhydrous grape sugar from corn and analogous farinaceous material.*" 2nd June, 1906. This invention relates to a process for the production of anhydrous grape sugar from a grape sugar liquor, which consists in treating the liquor with "induction" seed, allowing the liquor to crystallize under continual agitation, and separating the mother liquor and the crystals.

GERMAN.—Abridgments.

179861. Askan Muller, of Hohenau, Lower Austria. *Apparatus for conveying disinfectants into sugar beet slicing machines.* 13th July, 1905. In this apparatus the feed device for the disinfectants is governed from an operating device adapted to the quantity of the roots (sugar beet elevator, weigher, shreddings machine) in such a way that the quantity of the disinfectant coming into the slicing machine stands in a given proportion to the quantity of sugar beet introduced.

180620. Auguste Pagniez, of Caudry, France. *A process and apparatus for the permanent saturation of sugar juice.* 29th April, 1905. This process consists in the gas being introduced from beneath under moderate pressure into the juice through a pipe communicating with an open vat containing juice, the emulsioned liquid which then results rises in the tube and is then conveyed into a settling vat. A suitable apparatus for carrying out this process consists in a special form of the pipe, communicating with the juice vat, for the elevated juice, in which in order to regulate the action of the gas on the liquid, the pipe is made telescopic, or provided with discharge apertures adapted to be closed by means of valves.

180665. Andreas Harre, of Warburg, near Westphalia. *A process for making a masse-cuite adapted for producing cube sugar without casing.* 7th November, 1905. This process for making a masse-cuite adapted for producing cube sugar consists in mixing crystallized sugar with hot pure saturated sugar solution, filling the soft mass into moulds, in which it is allowed to cool, and centrifugalling without the use of casing cleare.

180830. Arabol Manufacturing Co., of New York. *A process for making starch capable of swelling in cold water.* 29th March, 1905. The starch is first mixed with a liquid hydrocarbon insoluble in water, or with a liquid hydrocarbon derivate insoluble in water, for instance, with tetrachloride of carbon, and then caustic potash is added thereto.

180769. Friedrich Closs, of Böblingen, Wurtemberg. *An insertion in a diffusion vessel for preventing too great a pressure on the sieve or strainer.* 13th March, 1906. This insertion consists of one or more suitably formed perforated plates, rings, or the like, which are preferably held together at the centre, and by means of suitable devices made capable of being tilted up.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of March, 1906 and 1907.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1906. Cwts.	1907. Cwts.	1906. £	1907. £
Germany	2,518,421	2,251,767	1,063,760	1,016,949
Holland	35,092	55,763	13,143	23,437
Belgium	186,450	109,583	75,750	46,609
France	153,331	41,219	65,220	21,089
Austria-Hungary	102,082	231,875	42,255	105,767
Java	87,958	64,058	41,451	33,230
Philippine Islands	....	20,000	....	8,500
Cuba	111,910	....	41,943	....
Peru	192,138	93,513	90,760	42,726
Brazil	541,575	186,687	214,066	74,439
Argentine Republic	....	....	....	....
Mauritius	30,769	128,459	12,068	52,749
British East Indies	....	....	....	....
Straits Settlements	18,012	40,063	7,882	17,665
Br. W. Indies, Guiana, &c.	372,878	392,999	223,146	226,264
Other Countries	27,018	217,522	12,347	107,290
Total Raw Sugars	4,377,634	3,833,508	1,903,791	1,776,714
Refined Sugars.				
Germany	2,598,972	2,667,052	1,485,699	1,549,932
Holland	693,267	723,866	413,158	448,145
Belgium	78,412	68,949	45,937	41,917
France	559,452	473,029	309,940	269,650
Other Countries	307	157	191	191
Total Refined Sugars	3,930,410	3,933,053	2,254,934	2,309,835
Molasses	662,938	656,684	133,792	130,472
Total Imports	8,970,982	8,423,245	4,292,517	4,217,021

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	127	178	114	116
Norway	4,398	4,022	2,708	2,359
Denmark	19,798	21,810	10,098	11,250
Holland	20,574	18,627	12,096	12,138
Belgium	2,442	2,670	1,283	1,572
Portugal, Azores, &c.	10,815	8,591	5,863	4,679
Italy	11,705	5,959	6,162	3,108
Other Countries	150,666	75,835	95,942	55,867
	220,525	137,692	134,266	91,089
Foreign & Colonial Sugars				
Refined and Candy	3,349	2,827	2,464	2,142
Unrefined	52,536	11,421	28,036	6,469
Molasses	4,710	1,433	1,475	376
Total Exports	281,120	153,373	166,241	100,076

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to April 18th ..	654,486	..	595,200
Receipts of Refined ,, ,, ...	355	..	525
Deliveries ,, ,, ...	625,048	..	602,872
Consumption (4 Ports, Exports deducted) since January 1st..	501,320	..	485,150
Importers' Stocks, April 17th	29,438	..	30,861
Total Stocks, April 24th	318,000	..	325,120
Stocks in Cuba, ,, ...	417,000	..	280,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1906 AND 1907.

(Tons of 2,240lbs.)	1906. Tons.		1907. Tons.
Exports	377,691	..	554,760
Stocks	265,316	..	449,932
	643,007	..	1,004,692
Local Consumption (three months)	12,075	..	12,500
	655,082	..	1,017,192
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 31st March	635,632	..	1,017,192

Havana, March 31st, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE MONTHS ENDING MARCH 31ST.

SUGAR.	Imports. 1905. Tons.		Imports. 1906. Tons.		Imports. 1907. Tons.	Exports (Foreign). 1905. Tons.		Exports (Foreign). 1906. Tons.		Exports (Foreign). 1907. Tons.
Refined	153,018	..	196,520	..	196,652	222	..	167	..	141
Raw	160,618	..	218,882	..	191,675	547	..	2,627	..	571
Molasses	26,144	..	33,147	..	32,834	12	..	235	..	72
Total..........	339,780	..	448,549	..	421,161	781	..	3,029	..	784

	Home Consumption. 1905. Tons.		1906. Tons.		1907. Tons.
Refined..	147,012	..	188,572	..	184,109
Refined (in Bond) in the United Kingdom	115,729	..	140,224	..	119,542
Raw	18,977	..	30,473	..	19,405
Molasses	26,621	..	31,738	..	28,432
Molasses, manufactured (in Bond) in U.K.	14,296	..	18,039	..	18,951
Total	322,635	..	409,046	..	370,439
Less Exports of British Refined......................	4,712	..	11,026	..	6,885
Total Home Consumption of Sugar	317,923	..	398,020	..	363,554

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, APRIL 1ST TO 20TH, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1907.
178	1102	660	675	200	2816

	1906.	1905.	1904.	1903.
Totals	3120 ..	2180 ..	2844 ..	2763

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING MARCH 31ST, IN THOUSANDS OF TONS.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1813	1224	648	548	206	4441	3948	4101

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1906-1907.	1905-1906.	1904-1905.	1903-1904.
	Tons.	Tons.	Tons.	Tons.
Germany	2,250,000 ..	2,415,136 ..	1,598,164 ..	1,927,681
Austria	1,335,000 ..	1,509,870 ..	889,373 ..	1,167,959
France	755,000 ..	1,089,684 ..	622,422 ..	804,308
Russia	1,450,000 ..	968,000 ..	953,626 ..	1,206,907
Belgium	280,000 ..	328,770 ..	176,466 ..	209,811
Holland	190,000 ..	207,189 ..	136,551 ..	123,551
Other Countries .	440,000 ..	415,000 ..	332,098 ..	441,116
	6,700,000	6,933,649	4,708,758	5,881,333

THE

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☞ All communications to be addressed to the Editor, Office of "The Sugar Cane," Altrincham, near Manchester.

All Advertisements to be sent direct.

Cheques and Postal Orders to be made payable to NORMAN RODGER, Altrincham.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editor will be glad to consider any MSS. sent to him for insertion in this Journal and will endeavour to return the same if unsuitable; but he cannot undertake to be responsible for them unless a stamped addressed envelope is included.

NOTICE TO READERS.—If the Advertisement pages stick together, bang their edges on the table, when they should easily separate.

NOTES AND COMMENTS.

The Colonial attitude towards the Brussels Convention.

As the time draws near for the Government to express its decision with regard to the Brussels Convention, it is becoming evident that the Colonies view with no small alarm the threatened denunciation of this measure. Petitions have already been sent to the Government on behalf of the commercial communities in Trinidad and Barbados, earnestly deprecating any change. Now certain Indian chambers of commerce are joining in the protest. Thus the Karachi Chamber has declared that the "continuation of the Convention would be in the "interests of the sugar trade generally and the trade with India in "particular as the countervailing duties are a distinct disadvantage "to free working." This Chamber thereupon resolved that the Chambers of Bengal, Bombay, Madras, Upper India and the Punjab be informed accordingly and asked to make a joint representation to His Majesty's Ministers through the Indian Government. This is definite enough. But worse is to be told, for the uncertainty which prevails is already debarring capitalists from going on with schemes. Thus while the central factory in Antigua was the outcome of the

signing of the Brussels Convention, an important scheme for a similar factory in St. Kitts has had to be abandoned till more auspicious times. If the denunciation of the Convention does take place, then in the opinion of the Antigua Agricultural and Commercial Society, we can "confidently predict at an early date the practical extinction "of the sugar industry in the British West Indies unless it is fated "for these colonies to prosper under another flag." The last sentence is really ominous and were it not for the fact that it is, we believe, only an important minority at home who cold-shoulder the colonies and not the nation as a whole, one would have just grounds for fearing that this change of flag was much nearer realization than the Little Englander party at home profess to believe or would care to admit. But we have strong hopes, as our comments on the Colonial Conference will show, that the country will ere very long express with no uncertain voice its determination to reciprocate the good feeling of the colonies towards the mother country and this in some tangible form, in which case it may be assumed that the West Indies will benefit as far as their premier industry is concerned. One's only fear is that by the time the way is open for this reciprocity on our part, the doors, now standing wide open to us, may then be only ajar and that the industries which we can best help will be too far ruined to be capable of recovery with their existing capital. Of course new capital can always be found, but it is poor consolation to obtain it when knowing that it is to replace old firms and proprietors who are all ruined.

The Imperial Conference.

The Imperial Conference, as the Colonial Conference is now designated, has come to an end, and has left behind it a feeling of acute disappointment amongst those who had expected great things from it. But all who were familiar with the uncompromising attitude of the present Liberal Government scarcely dared to hope that anything more would ensue than the placing on record of the differences in opinion existing between the Home Government and the representatives of the Colonies. Even the Colonial Premiers, with one or two exceptions, were not over-sanguine. But we think none of them were prepared for the rough treatment they actually received when the question of Imperial Preference came up for discussion. Our readers will be able to see on another page what the Government's answer was. To quote the phrase of the moment, the latter have deliberately "banged the door in the face" of the Colonies, and in the words of Mr. Winston Churchill, the Under-Secretary for the Colonies, they have not only banged the door but have, moreover, barred and bolted it, and as long as Sir Henry Campbell-Bannerman is in power it will never be opened. The latter grandiloquently claims that the country have given his party a final mandate to maintain the fetish of free trade. We may not, therefore, hold out our hands to our

countrymen across the seas nor join with them in a commercial union, because our fiscal system would thereby suffer disturbance. So the Colonies are simply told to go their way and do what they think best, while at the same time we are to continue along the old paths.

But if Sir Henry Campbell-Bannerman thought that this decision would meet with the approval of the vast majority of the people in this country, he is finding out already that he has been mistaken. Hitherto, a great many people have been neutral in the matter of Colonial Preference because they did not understand the question, and besides were not convinced that the Colonies were prepared to offer us a *quid pro quo.* They therefore voted against tariff reform at the last election. The Conference has, however, come as something of a revelation to them, and they are now satisfied that the offers made to us by the Colonies are worth reciprocating. Many of these waverers have already come over to the reform party. It is therefore evident that however meagre have been the results of a direct nature, the Conference has done much good indirectly in educating public opinion on the subject. It has given tariff reform an immense fillip, and the bye-election at Wimbledon just after the close of the Conference has added considerable point to this view. Mr. Henry Chaplin, a strong tariff reformer, who, at the last election, was turned out of one of the safest seats, stood for this constituency in the place of another Unionist retired. His opponent, while not an official Liberal, received the almost unanimous support of the Liberal party and the Liberal press. Yet the Unionist majority was increased from 2,114 to nearly 7,000. This was a decisive victory, and another nail was driven in the coffin of "free trade."

Besides, the Conference has impressed foreign nations with the strength of our imperial unity, for the spectacle of this big family gathering which is to recur every four years must have its influence on those nations who secretly hoped that our Colonies were drifting away from us; instead of this there is every indication that they desire to form a closer union, and it is only the fiscal opinions of the present Government and not the attitude of the country at large which prevents this from being sooner realized. Apart from this result, the political effect has been very considerable. People have now had the opportunity of hearing at first hand from the representatives of the Colonies exactly what the latter are prepared to do, and the plea that they have made us no definite offer can no longer be advanced. It only remains for us to drive home the lesson, and we think that before very long the electorate may have the opportunity of again expressing their opinion upon the whole subject, when we may look forward confidently to a reversal of the mandate which the present champions of free trade never tire of telling us they received at the last election.

Mr. Martineau on the Brussels Convention.

The April number of the *British and Foreign Confectioner* gives premier place to an article by Mr. George Martineau, C.B., on the Sugar Convention. We are glad to note that since our contemporary has come under new management it has dropped the biassed tone—not to put it more strongly—that it assumed towards all those who felt justified in supporting the Brussels Convention as a free trade, not to say fair trade, measure. It is no exaggeration to say that till a short while ago a cheap sneer at the expense of certain well-known contributors of ours was a regular feature of that paper's editorials. It is, therefore, a pleasure to note that all this has now disappeared and that there is instead a willingness to hear the other side, as a result of which we have the publication of a paper from the pen of one of the leaders of the Convention party.

Mr. Martineau's paper is in the main a historical résumé of the repeated attempts to get a Convention signed. He begins with the sixties, and takes care to point out that the late Mr. Gladstone was personally convinced of the fairness of such a measure. It seems clear that he passed without hesitation the penalizing clause in the 1864 Convention, for the failure of that Convention was not caused, as was the case with subsequent Conventions, by any refusal on our part to apply this penalty. It was because France refused to carry out the provisions agreed to, that it met with an untimely fate. We fancy that no one now regrets this more than does the French sugar industry, which has as much to lose by the possible denunciation of the present Convention as any other party to it. Mr. Martineau traces the failure of successive negotiations and the rise of the Kartell bounties, till finally in 1902 a British Government possessing the requisite courage gave the necessary guarantee and a fresh Convention was signed. The paper concludes by dealing with some of the fallacies extant since that date with regard to the effect of the Convention on prices, which fallacies have been so repeatedly exposed in our columns.

Cuba.

The crops all over Cuba, with the exception of the extreme east, are finishing up very early and short, owing to the unprecedented drought now being experienced. It is not thought that the total crop will exceed a million tons, canes as now cut proving as dry as sticks. The new plantations at the eastern part of the island are reaping considerable benefit from the weather conditions, such as Nipe, where the juice has surpassed expectations; the virgin soils as a rule, containing so much humus, give a heavy weight of cane with poor sugar-content, but this has been reversed this year. Political conditions continue no better, and it is almost certain that in the district of Santa Clara there will be disturbances with possible burning of cane fields if the

weather permits, but the present unusual number of fires is due to accidental causes, and great destruction has been caused by them. The New York papers make out that they are set on fire intentionally; but this is certainly not the general case though of course there are isolated instances. The United States has decided to first take a census of the island before proceeding to the election of a President; this will occupy a year, during which time the troops remain.

The Identity of Seedling Canes in Demerara.

Our statement in last month's *International Sugar Journal* with regard to the identity of the B 208 canes cultivated on the Diamond Estate in Demerara, has evoked the following telegraphic reply from Sir Daniel Morris in Barbados:—"Your statement respecting Diamond Cane B 208 absolutely without foundation." Till further details arrive from him it might be as well to suspend judgment; but we may remark here that our information was derived from a correspondent stationed on the spot, in whom we have implicit confidence, and who is hardly likely to have made this charge without some definite evidence in support.

The Estimation of a Cane Crop.

On another page will be found a contribution from the pen of Mr. Carlos Hamakers (a former colleague of Mr. Geerligs in Java), describing a new and improved method in the estimation of cane crops. Having himself studied the question in Java and noted how frequently the local experts were at fault, he came to the conclusion that no estimates which ignored the factor of the average diameter of the canestalks could hope to be successful. He therefore decided to draw up his estimates on this basis, and his paper describes the *modus operandi.* But we must say that his proposals appear to us to involve an amount of labour which is out of all proportion to the value of the information sought. An estimate based on the yields per hectare in previous years should be sufficient for the sugar manufacturer, due allowance being made for abnormal meteorological conditions or diseased conditions of the crop. The canes must, of course, be weighed at the factory by a competent weigher, and the area under cultivation, as also the rainfall, recorded year by year. In any case, the factory (or mill) should be prepared for a maximum crop *every year* and not delay grinding operations until the last moment.

Mr. Noel Deerr.

Mr. Noel Deerr, well known to our readers as the author of a standard work on sugar, has just been appointed Assistant Director of Chemistry at the Sugar Experiment Station of the Hawaiian Planter's Association in Honolulu. While regretting the loss to our Colonies

of such a skilled worker, we must yet congratulate him on his appointment to a post where he will almost certainly get more scope for using his abilities than previous appointments have offered him. It is, however, a regrettable state of affairs that such men cannot apparently be kept within the Empire, because they are neither offered a sufficiently lucrative appointment nor given a free hand commensurate with their skill. Foreign employers are more generous, and consequently we are in danger of losing all our best men. Mr. Deerr is not the first British subject of his class who has gone to Hawaii, and, we fear, he will not be the last, unless more attention is given to retaining such men in our Colonies.

THE SUGAR CONVENTION.

From the Confectioner's Point of View.

We have had many manifestos from the confectioners from time to time on the Sugar Convention and its effects, but now we can read the matured results of their investigations as published with much deliberation and praiseworthy moderation in *The British and Foreign Confectioner* for May, 1907. Let us examine them carefully and see what they amount to.

The writer begins by telling us that "he has opposed the proposal for our adherence to such a Convention for the last twenty years," that is, ever since 1887. But if we recollect right it was in 1889 that two of the largest firms of confectioners wrote to Sir Nevile Lubbock, the Chairman of the Anti-Bounty League, giving him their cordial support in his efforts to obtain a Convention. One of them "begged to say," with regard to the proposed legislation, "that we have the firmest conviction that, after a short interval, this Kingdom would be provided with a larger, a better, a cheaper, and a more reliable supply of sugar than it has ever yet had; and that if once real free trade in sugar be established we shall not be again liable to any such sudden and immense rise (really 50%) as that which is now paralyzing the confectionery and allied trades." This was pretty straight and to the point, and the other firm was perhaps even more emphatic. If the writer of the present article in *The Confectioner* took a different view he certainly failed to make it widely known.

His summary of the objections to the Convention comes to this:—first, that it would limit the fiscal freedom of this country; secondly, that it would limit the area of supply; and, thirdly, that it would increase the cost of sugar all round.

As to the first, the facts completely contradict his assertion. He declares, with regard to the decisions of the permanent International

Commission, that "on every important point on which we have taken a line of our own we have been in a ludicrous minority." On the contrary, on every point affecting our "fiscal freedom" where we took a line of our own and resisted the proposals of the Commission, we were successful.

The second objection, limitation of the area of supply, can at once be shown to be an imaginary bogey. There are only two countries of any importance which persist in giving bounties, and whose sugar is therefore shut out, Russia and Argentina. Their sugar, if they have any to export, goes to some other part of the world, and displaces other sugar which can come here instead. There is, therefore, no limitation in our area of supply; nor is there any interference with the price of our sugar, because our price is always the world's price, and so far as exports from Russia and Argentina swell the world's supplies and thereby reduce the world's price, we reap the benefit with the rest of the world.

On the third objection, that the Convention "would increase the cost of sugar all round," the question naturally arises—from what level is the increase to be reckoned? If it is the average price of sugar that is to be raised, the reply is that as the present cost of production is lower than the average price of former years, and as now, with free competition, the price of sugar will be governed by cost of production, it is clear that sugar will evidently be cheaper not dearer. If, on the other hand, it is only meant that the Convention will raise the price of sugar from what it was in 1902, when it was 3/- per cwt. below the cost of production, the answer is that in any case sugar could not have continued below cost price; and that if there had been no Convention and the low price had continued for another year or two, Germany and Austria would have become masters of the situation, because no other producer could have maintained the competition.

Those are the three dry, hard, unanswerable replies to the three objections; they really close the discussion.

But there are many more columns of words, some of which tempt to further criticism. For instance, the writer wants to know what people mean who talk about the "natural" price of sugar. Well, we will first tell him what is meant by an "unnatural" price. When bounties have helped to build up a great industry which once supplied two-thirds of the consumption of the world, and which went on increasing until every market was glutted and prices had fallen 3s. per cwt. below the cost of production, then we say that that is an unnatural price—first, because the over-production is caused by bounties; and, secondly, because the bounties enable some competitors to go on producing even at that low price, and thus to drive out all other competition and remain masters of the situation. When that state of things is stopped and competition becomes free, the

price is governed solely by the cost of production, subject, of course, to the ordinary fluctuations arising from good or bad crops, or from increased consumption. Then we have the natural price. The difference between the two conditions seems sufficiently intelligible even to the meanest capacity, but we are not surprised at this writer's failure to grasp it when we see the same blindness among the most distinguished statesmen in discussing this or other cognate questions.

The writer, however, goes on to say that he deals with actual facts, whether natural or unnatural, and then proceeds to compare the prices of 1901-2, which were 3s. per cwt. below cost of production, with the prices of 1904-5-6, which were entirely upset by the failure of the beetroot crop of 1904, a crop deficient to the extent of 1,200,000 tons. The bounties caused the glut of sugar in 1901-2, which brought the prices down to a ridiculous and ruinous figure. They also helped to increase the European beetroot industry until the world became dependent on it for the greater part of its supplies. Whenever the European crop suffers from a bad season there is a big rise in sugar. That is one of the happy results of the sugar bounties, and that is what happened in 1904-5. The price of sugar was doubled; then, of course, they sowed more beetroot than ever. There was a good crop, plethora was substituted for scarcity, and down went prices to the old level. All this was the effect of bounties, as our story clearly proves, and yet the confectioners still want people to believe that the high prices of 1905 were caused, not by bounties, but by their abolition.

Here again is a case where the real facts are as clear as the day, but where, no doubt, the misrepresentations will prevail and be accepted by statesmen as quite unanswerable.

There are plenty of other errors which we might expose, but enough has been said to knock the bottom out of Mr. de Jastrzebski's argument.

The real complaint of the confectioners may be briefly summarized in these words. The price of sugar in 1901-2 was so low that confectionery could be sold at prices which greatly stimulated consumption. They therefore think it a grievous thing that they should be deprived of sugar 3/- per cwt. below cost price. They see no reason why sugar should not be supplied to them for ever at that figure. And as to the sugar duty, it is an iniquitous thing that consumers of sugar plums or marmalade should ever contribute to the revenue. But why not? Even the duty-paid price of sugar is under 2d. per lb. There are no consumers of confectionery who are hurt by such a price as that. Even the profits of the makers seem to continue to flourish.

The Acadia Sugar Refining Company, of Nova Scotia, have just declared a dividend of 3% on their Preference Shares.

THE COLONIAL CONFERENCE.

The British Colonial Conference, which assembled in London during April, began its sittings on the 18th of that month. Those attending it included the Earl of Elgin, Secretary of State for the Colonies, who presided, the Prime Ministers of Canada, Australia, New Zealand, Cape Colony, Transvaal, Natal, and Newfoundland, and other Colonial representatives.

The first day's conference was confined to a discussion of a resolution with regard to the constitution of the Conference. It was understood that all the Premiers, with two exceptions, were in favour of periodical Imperial Conferences. It was finally unanimously resolved that it was to the advantage of the Empire that a Conference, to be henceforth called the *Imperial Conference,* should meet every four years, the Prime Minister of the United Kingdom being *ex officio* president, and the Prime Ministers of the self-governing colonies, as well as the Colonial Secretary, *ex officio* members. It was further resolved that it be desirable to establish a permanent secretarial staff under the direction of the Colonial Office, charged with the duty of obtaining information for the use of the Conference, and of carrying on all correspondence relating thereto. The question of Imperial Defence next met with some discussion.

It was not till the eighth sitting that the burning question of Imperial Preference came up for discussion, when Mr. Deakin, the Prime Minister of Australia, brought forward a resolution in favour of preferential tariffs between the United Kingdom and the Colonies, three paragraphs of which were taken from the resolutions of the 1902 Conference. These were:—

> 1. That this Conference recognizes that the principle of preferential trade between the United Kingdom and his Majesty's dominions beyond the seas would stimulate and facilitate mutual commercial intercourse, and would, by promoting the development of the resources and industries of the several parts, strengthen the Empire.
>
> 2. That this Conference recognizes that, in the present circumstances of the Colonies, it is not practicable to adopt a general system of free trade as between the Mother Country and the British dominions beyond the seas.
>
> 3. That with a view, however, to promoting the increase of trade within the Empire, it is desirable that those Colonies which have not already adopted such a policy should, as far as their circumstances permit, give substantial preferential treatment to the products and manufactures of the United Kingdom.

To these, on behalf of the Commonwealth of Australia, he added:—

> That it is desirable that the preferential treatment, accorded by the Colonies to the products and manufactures of the United Kingdom, be also granted to the products and manufactures of other self-governing Colonies.
>
> That it is desirable that the United Kingdom grant preferential treatment to the products and manufactures of the Colonies.

The Governments of both New Zealand and Cape Colony also submitted resolutions declaring that it was desirable that the United Kingdom should now concede preferential rates of duty on Colonial products. Mr. Deakin followed up his resolutions with a strong appeal for preference, which, he declared, would tend to build up our dominions beyond the seas. He suggested the appointment of a Committee of experts to review the trade of the Empire as a whole. He pointed out that while on the one hand the trade of the United Kingdom was losing ground in all great markets, and losing it mainly to protectionist rivals, the development of Australia and the Colonies generally was, on the other hand, retarded by the fact that except in the case of certain raw materials their products were shut out from protectionist markets and yet likewise elbowed out of the free market of the United Kingdom. The latter took 213 millions sterling a year in goods, all of which the Colonies were capable of supplying, but of which at present only £10,000,000 came from Australia, £40,000,000 from other Colonies, and the balance £160,000,000 from foreign countries. What Australia and her sister Colonies desired was a secure and ample market in the United Kingdom to people their empty acres and increase their economic power, whilst England's need was a growing market to take the products of her dense industrial population. The two needs were indeed complementary.

Mr. Deakin was followed by the Premier of New Zealand (Sir J. Ward), who said that the question of preference should be raised above party politics; and by Dr. Jameson, of Cape Colony, who said he endorsed every word Mr. Deakin had uttered. General Botha and Sir Robert Bond contented themselves with re-affirming the resolutions of 1902.

Mr. Asquith, the Chancellor of the Exchequer, replied on behalf of the British Government. He began by paying a tribute to the ability and clearness with which the case for the colonies had been presented. It had breathed the spirit of Imperial unity, even though revealing differences of opinion. He believed in fiscal independence, without which self-government would be worthless. That independence the colonies had fully received, and if they thought it their duty to foster industries by protective tariffs, their action would not evoke even criticism from him. He noted that various self-governing Colonies gave preference to the Mother country, but it was a fact that

those preferential tariffs did not admit the manufactures of the Mother country to compete on equal terms with the local product. Doubtless the Colonies held this to be vital to their interests, and in the same way His Majesty's Government held that Free Trade was vital in the interests of the United Kingdom. He considered the supremacy of Great Britain must be attributed to our special industrial activity, from the profits which we obtained by keeping the biggest open market in the world, and to the enormous earnings of our shipping. Free Trade was no shibboleth, but a vital principle. After the fullest examination the people of this country had declared in favour of Free Trade by a majority of unexampled size. As spokesman for the people, the Government, therefore, could not accept any infringement of that policy. He then proceeded to offer some observations on some points raised during the discussion. He considered we were getting most-favour-nation treatment everywhere, and stood on the whole better in protected markets than did protective nations. Discussing the preferential tariffs existing among the Colonies, he admitted that they had been of some benefit to this country; but Great Britain stood in the position of offering the freest possible market, and preferential tariffs would involve the giving of less to other people and not of more to the Colonies. Again, to be of any value, they would have to be given on raw materials and foodstuffs. This would attack the very citadel of Free Trade, and, therefore, for these reasons, his Majesty's Government, speaking for the people of the country, could not accept the principle of preferential trade by way of tariff preference.

Mr. Lloyd-George also spoke on this subject at a subsequent sitting. While not quite so hostile in his tone, he had to take much the same line as his leader. He said the Government were in favour of any scheme that would tend to improve inter-Imperial trade, so long as the rights of individual communities were not thereby sacrificed. But in this case the Government were asked to tax necessaries which we could not produce ourselves and with which the Colonies could not adequately supply us for many years. He therefore thought consideration should rather be given to proposals for improving and cheapening cable communications, the appointment of commercial attachés, and the improvement of transport, especially the last named. He could not, however, undertake to grant subsidies.

The *Times*, in commenting on Mr. Asquith's speech and the trenchant reply made the day after by Mr. Balfour at the Primrose League Demonstration, said :—

" To put the matter at the lowest, we are offered on easy terms an alliance for mutual advantage with a number of self-governing communities, and the Government has no other answer than blank refusal either to accept it now or to hold out any prospect of giving it more favourable consideration at any

later moment. That is the answer of men who profess the greatest desire for the unity and consolidation of the Empire. People naturally ask themselves how it is that men having that desire can do nothing better than oppose a *non possumus* to the only proposals actual or possible for the attainment of their desire. The answer is that, desirable though the end in view may be, our fiscal system opposes an insuperable barrier. Whereupon the thought must surely arise in every serious mind that any fiscal system which compels such an answer to friendly overtures must have very grave defects, however much may be said for it in other respects. Our kinsmen and descendants, to the number in the aggregate of nearly half the population of these islands, offer us arrangements which would certainly enlarge our markets and provide employment for our workmen, besides consolidating our Imperial position. The importance and desirability of these things are patent to all, and are not denied by Mr. Asquith; but we may not reach forth to take them, because our fiscal system offers no facilities. It had need to be a remarkably fine and successful fiscal system to be worth preserving in spite of such a limitation . . . . What we have to contend with is not free trade, but a pedantic theoretical perversion of the doctrine. Free trade forbids the imposition of duties to bolster up industries which cannot face fair competition. The pedantic perversion forbids the imposition of any duty which may incidentally give any advantage to a home industry, even though it has to face a thirty per cent. foreign tariff in addition to fair competition. Therefore, we may not tax anything that is or can be produced in this country. Therefore, there are very few things that we can impose a duty upon, and these few things have to bear a taxation which, as Mr. Balfour says, is from the *ad valorem* point of view, preposterous. We may not broaden the basis, however great our need. We may not put a duty upon anything coming from abroad that might be made at home, although other nations tax it so heavily that it cannot be made at home. However dire our fiscal need, we may not use the liberty allowed by genuine free trade theory to impose taxes for revenue, even though they incidentally countervail the taxes imposed by other countries upon our goods. Consequently, we must resort to the crudest system of finance known among civilized men—an income tax of a shilling in the pound, and absurd imposts, exceeding the value of the things taxed, upon a very small number of articles. That is our sacred fiscal system, for the sake of which we must relinquish all hope of extending our markets and of binding the Empire together by community of material interests. It is not founded on reason, it runs directly counter to manifest expediency, it hampers our Imperial as well as our commercial development, and it is not even called for by the theory of commerce on which it professes to be founded. But all these things matter nothing. The system is our fiscal system. It is our own pet particular fetish. It has stood in the wigwam ever since we were children, and to question its virtue might bring the thunder."

It is pointed out that rotten fruit can be utilized for the manufacture of alcohol, and that, therefore, there is no need for fruit growers to throw aside such waste products.

THE SUGAR INDUSTRY IN INDIA.

At the recent Indian Industrial Conference held at Calcutta, Mr. H. Vencoba Rao, of Madras, read a paper on "The Sugar Industry of India." He began by referring to a previous paper of his read to the South Indian Association at Madras, on "The Problems of the Sugar Industry," in which he had discussed the chief points that engaged the attention of cane growers. The most prominent defects noticed by him in the Indian sugar industry were (1) the sporadic cultivation of canes in small plots of land, (2) the waste that occurs in consequence of defective crushing in primitive mills, (3) the manufacture of raw sugar in the form of jaggery or *gur*, (4) the difficulty of transport of canes to the factory and sugar to the market, and (5) the absence of demand from foreign countries for Indian raw sugar. He drew the attention of all those interested in the sugar industry in India to the increasing demand for refined sugar and the inability of the manufacturers in India to meet that demand. It was pointed out by him that cheapness was the sole recommendation in favour of foreign beet sugar. The remedies suggested were (1) the application to cane of the very same methods as are adopted for the manufacture of sugar from beet on the Continent of Europe, (2) the establishment of central factories on the coast with a view to develop the export trade in sugar, (3) the extension of cane cultivation in the deltaic tracts of such rivers as the Cauveri, the Tambraparni, the Kistna, the Godavari, and even the Ganges in close proximity to these central factories, (4) the institution of a sliding scale of prices in regard to canes delivered on sale into the factories, (5) the arrangement with the railway companies for a reduction of fare in respect of canes brought to the factories for sale and of sugar transported to the market for consumption, (6) the utilization of the labour of returned emigrants in cane cultivation.

Not being himself an expert in sugar matters he had some doubts as to whether he had correctly diagnosed the causes of the impending ruin of the Indian sugar industry, but he had hoped that his paper would lead to an expression of opinion by those best placed to do so. It was clear that the cheap white beet sugars of German and Austrian origin were finding increasing favour in Northern India to the detriment of the native grown article.

Yet Mr. Vencoba Rao has to confess an entire absence of response to his appeal, and he is led to wonder whether the soul has flickered away from the body of the Indian industry. It is apparently left to *Tropical Life* to give him a solution. At any rate a good deal of his later paper is taken up with a consideration of the argument advanced by this home journal, that improved machinery is badly needed. We may remark here that another need was referred to by us in a previous number of this Journal to wit, that more education, especially of the

native Indian agriculturist, was badly needed. Once he learns the rudiments of scientific sugar manufacture he will set about turning out sugar on a more economical basis.

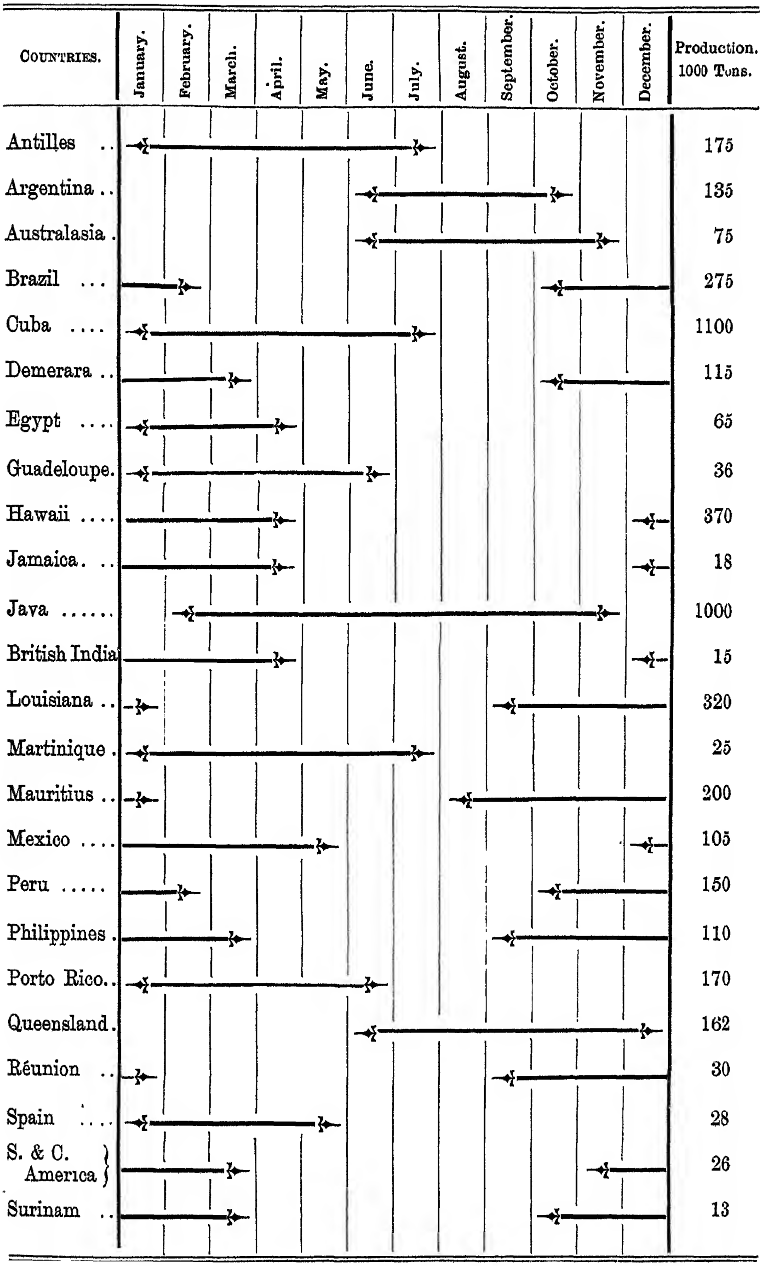
But to return to Mr. Rao's paper. He quoted figures from *Tropical Life*, the *Louisiana Planter*, and also from Mr. Nursey's recent paper before the Society of Engineers, to show how much more economically sugar is extracted by modern mills than by the Indian jaggery process, where but 50 to 60 per cent. of the juice is obtained. In this connection the practice in Hawaii and Antigua is cited at some length.

But we are sure it will not suffice to simply erect such plant in India, and then leave the native proprietor and the ryot to do the rest. India is too much tied to old customs to readily adopt new measures. One cannot expect the Hawaiian system to come into immediate existence. All the experience of years is lacking. Progress there must be, but it is only folly to conclude that it can be of spontaneous growth. Careful and judicious training of the workers is a necessary preliminary—in the case of better-class natives by means of a course at an agricultural college, and in that of the ryots by intermingling with them a sufficient number of Indians who have served an apprenticeship in British Guiana. Then when the native mind is prepared to adopt modern methods, it will be a comparatively small matter to supply him with the needed modern apparatus.

That, in our opinion, is the chief road to progress. But Mr. Rao's comparisons between the jute and cotton industries and the sugar industry, to the disparagement of the latter, should not be overlooked. It is clear that certain facts tend to make the Indian capitalist shy of taking up sugar when cotton or jute are an alternative. Why this is so is not altogether apparent. But Mr. Rao thinks that the difficulty of concentrating at the factory a large area of canes and passing the whole quantity through the mills within the short period of three or four months tells against this industry. Cotton and jute can be stored and worked up at their leisure, while canes must be ground within 24 hours of being cut. But other countries do not consider these to be insuperable disadvantages, so we may conclude that when India realizes the value of an efficient sugar industry she will make light of them too. In the meanwhile it is a matter for congratulation that the Government experiment stations are endeavouring to supply the planters with a satisfactory type of cane, and to that end are carrying out experiments on a large scale.

The increase in the sugar production of the Lower Zambezi is well shown by the fact that a specially-constructed steamer has been placed at Chinde with a view to trading between Chinde and Beira, and carrying sugar and labourers between those two ports. The boat was designed so as to be able to cross the Chinde bar with a large cargo.

(From the *Vereinszeitschrift.*)



MEGASS FURNACES.

By Richard Lloyd, Assoc.M.Inst.C.E.*

In this paper the writer describes some trials of ordinary megass furnaces, as used in British Guiana, with special reference to the quantity of air admitted for combustion.

"Megass" is the resultant fibre of crushed sugar-cane, and is burned in its "green" or undried state, being conveyed directly from the cane-crushing mills to the furnace. In ordinary seasons no extraneous fuel is used, the megass having sufficient calorific power to raise the steam required for working the factory.

In the undried state megass contains water, sugar, glucose and gums in varying quantities, according to the type and quality of the cane crushed, and the power exerted in the crushing; consequently its calorific value also varies. It has been determined by Messrs. Savre and Silbermann that 1 lb. of sugar-charcoal evolves 14,470 B.Th.U., and by Messrs. Stohlmann and Langbein that 1 lb. of fibre gives on combustion 7,533 B.Th.U.; 1 lb. of sugar, 7,120 B.Th.U.; and 1 lb. of glucose, 6,748 B.Th.U. As different varieties of canes are mixed in the milling, an average fuel-value is taken. This fuel-value has been computed by Mr. Noël Deerr, from samples of megass taken from various factories.†

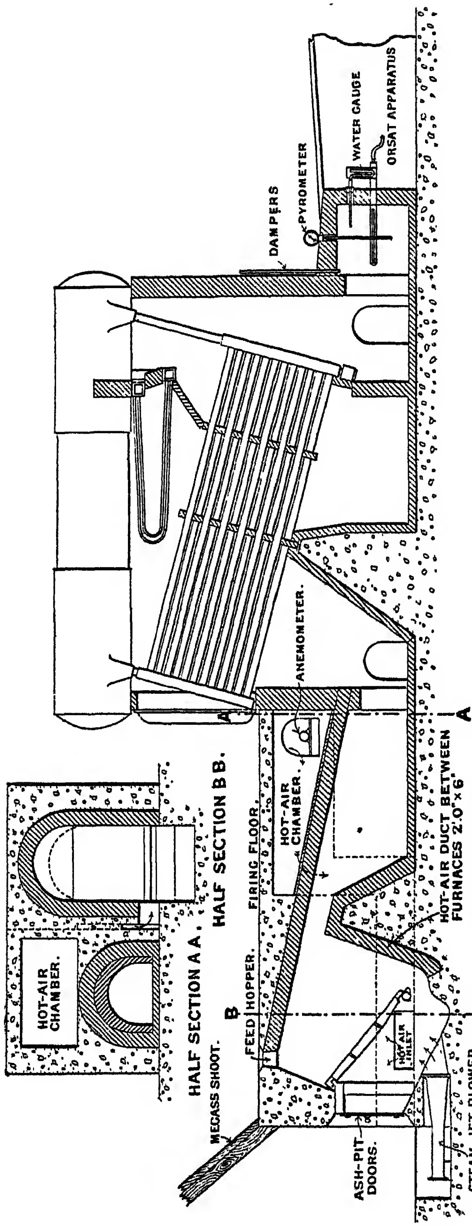
The combustible elements in megass contain hydrogen and oxygen in the same ratio as that in which they exist in water, so that in calculating the air required for combustion only the carbon need be taken into account. The volume of superheated steam resulting from the combined and associated water is considerable. The amount of associated water in green megass is determined by drying samples in an oven heated by steam, and is found to vary between 40 per cent. and 60 per cent. by weight. The various constituents of megass are found, on combustion, to contain the following percentages of water:—

Fibre, 55·6 per cent.; sugar, 57·9 per cent.; glucose and other organic bodies, one-tenth that found for sugar. The ash amounts to only 2 per cent. of the dry fuel consumed, and analyses of ash from six factories show an average of 4 per cent. unburnt carbonaceous matter, 62 per cent. silica, and 6 per cent. potash.

The trials were made in the factories of four adjacent estates, milling the same kinds of cane. The boilers in use in these factories are of four different types, namely (1) multitubular, (2) Lancashire with Galloway tubes, (3) Babcock and Wilcox, and (4) Stirling, the two last-mentioned being water-tube boilers. The total heating-surface is 43,700 square feet, of which the multitubular boilers

*From *Minutes of Proceedings of the Institution of Civil Engineers*, Vol. CIXVII., by special permission.

† "Sugar and the Sugar-Cane," by Noël Deerr.



LONGITUDINAL SECTION THROUGH ONE FURNACE.

Scale 1 Inch = 10 Feet.

FEET 10 5 0 10 FEET.

represent 72 per cent., the water-tube boilers 20 per cent., and the Lancashire boilers 8 per cent. The megass furnaces are constructed of fire-brick and are exterior to the boilers (*Fig. 1*). In order to obtain the highest temperature of combustion with megass-fuel it is necessary to burn it in a fire-brick furnace, leading into a combustion-chamber of ample dimensions, the flame from megass being of considerable length, usually 25 to 30 feet. The fire-brick combustion-chamber forms a heat reservoir, maintains an equable temperature, and prevents a rush of cold air upon the boiler. Two types of grates are in general use, the simple ordinary fire-bar grate, laid either horizontally or inclined at various angles up to 40 degrees, and the step- or ladder-grate. The fire-bars are usually 5 feet in length and 1 inch in thickness, with air-spaces 1 inch in width. The step-grate is inclined at an angle of 45 degrees, and the bars forming the steps are 4 inches in width by ½ inch in thickness, with air-spaces 2 inches in width, the ratio of grate-surface to heating-surface varying between 1 to 60 and 1 to 110 according to the chimney-draught. In a furnace having fire-bars 5 feet in length inclined at an angle of 40 degrees, forming a grate 15 square feet in area, with good chimney-draught, and under ordinary working conditions, the writer has burned 217 lbs. of megass per square foot of grate per hour. This furnace was attached to a multitubular boiler, 12 feet in length by 7 feet in diameter, having ninety-six tubes, 4¼ inches in diameter. The boilers are fired in all possible ways, the gases entering the tubes directly from the combustion-chamber, or, more usually, passing underneath the boiler, back through side-flues into a second mixing- or combustion-chamber, and thence through the tubes into the flues. An intense draught is required to burn "green" megass, especially that resulting from seedling-cane, in which the percentage of fibre is low. Even with a chimney-draught of ⅞ inch to 1 inch of water it has been found necessary to use a force-draught fan under the grate when burning megass from different varieties of seedling-canes. The feed-hopper is sunk in the firing-floor, which is formed by the furnace top. The megass is dropped upon the floor from the conveyors, or tipped from wagons, and is fed into the feed-hoppers by coolie firemen with the aid of an ordinary hay fork or forked stick. All due care is exercised, having regard to the class of firemen employed, to keep the feed-hopper full of megass, to maintain a steady and constant supply of fuel, and to prevent excess of air leaking in through the hopper. A considerable excess of air, however, does flow through the hoppers with the fuel, as will be shown later. Hot air chambers are formed in the space between the sloping furnace-arch and the firing-floor constituting the furnace top. Air is allowed free access to the heating chamber and is conveyed by ducts under the grate, giving a rise in temperature of 300°F. Thus heat is used that would otherwise be dissipated

by radiation. Of the four factories, three work with chimney-draught and one with induced-draught fans fixed at the base of the discharging-chimney. In two of the factories worked with chimney-draught, Granger steam-jet blowers were used under the grates to supplement the chimney-draught. Observations were made of the temperatures of the air, water and flue-gases, the volume of air admitted, the steam pressures and the intensity of the draught, for 20 days, and some 74 analyses of flue-gases were made with an Orsat apparatus during that period. The results of the trials are given in Table I. In order to obtain complete data, trials were made with a water-tube boiler under three different conditions of air-supply to the furnace, viz., (1) with hot air, (2) with steam-jet blowers, and (3) with cold air. This particular boiler was chosen as being entirely separate from the rest of the battery, having its own feed-pump, flue, and separate division in the chimney, extending 10 feet above the base. In all cases no special preparations were made, normal working conditions being maintained throughout. The flue-gas samples were taken, whenever possible, at the back of the boiler, but failing this they were taken from the flue, close to the boiler. The boiler was erected in May, 1904, and had been at work for two seasons. The trials were made at the end of the 1905 crop, the boiler having worked continuously for 14 weeks without cleaning.

The following are the conditions under which the trials were made:—

The megass was elevated from the last mill, and discharged into wagons holding about 14 cwts. of megass. The wagons were passed over a weighing-machine, weighed, and side-tipped on to the firing-floor. Water was allowed to gravitate from the factory-tank to a measuring-tank having a capacity of 453 lbs., the admission of water being regulated by a cock. A cock was also fitted into the bottom of the measuring-tank, to discharge the water into the supply-tank attached to the feed-pump. The tank was weighed before and after each trial, and a revolution-counter was attached to the feed-pumps as a check on the water pumped, and on the regularity of the feed. The anemometer was fixed in the centre of the inlet to the hot-air chamber. Two U or siphon water-gauges, with movable index, and two gauge-recorders were used for registering the power of the chimney-draught. The pyrometer was fitted in the flue close to the dampers, but the dampers were withdrawn and the damper-holes were filled up. All joints in the brickwork were carefully examined, and leaks stopped. Water-level gauges were marked, and the water-level was maintained with very little fluctuation in both steam-drums, and at the close of the trials was at the gauge-mark. The boiler was under trial for 3 days of 7 hours, but observations were taken continuously for 5 days. Before the commencement of the trial the firing-loft was swept clean of megass, and the ash was removed from under the grate. Flue-gas analyses were made every 30 minutes.

TABLE 1.—RESULTS OF TRIALS OF MEGASS FURNACES ATTACHED TO SMOKE-TUBE AND WATER-TUBE BOILERS, WITH VARIOUS SYSTEMS OF AIR-ADMISSION.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Type of Boiler.	Air admitted	Draught obtained by	Volume of Gases. By Analysis.			Volume of Gases. By Difference.	Excess of Air $\frac{N}{N - \frac{79}{21} O}$.	Draught at back of Boiler.	Draught at base of Chimney.	Temperature of Gases leaving Boiler.	Weight of Flue Gases per lb. of Fuel.	Weight of Gases+Superheated Steam from Combined and Associated Water per lb. of Fuel.	Weight of Air admitted into Furnace. By Analysis	Weight of Air admitted for Combustion.	Weight of Air admitted through Hopper and Leakage.	Weight of excess Air admitted.	Thermal Units for 1 lb. of Fuel. Contained in 1 lb. of Fuel.	Thermal Units for 1 lb. of Fuel. Loss by incomplete Combustion.	Thermal Units for 1 lb. of Fuel. Carried away by Flue Gases.	Thermal Units for 1 lb. of Fuel. Carried away by contained Water.	Net Thermal Value of 1 lb. of Fuel. Col. 18—Col. 21.
			CO_2	O	CO	N	Per cent.	Inch.	Inch.	°F	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	B.Th.U	B.Th.U	B.Th.U	B.Th.U	B.Th.U
								Ashpit Doors closed.													
Multitubular	Cold ..	Fans .	13·34	8·16	1·0	77·50	64	0·73	1·12	541	4·59	4·61	3·59	..	.	1·40	3779	175	680	605	3174
Do.	Do. ..	Chimney	11·25	8·99	1·72	78·04	82	0·53	0·63	690	4·91	4·93	3·91	..	.	1·80	3779	337	835	526	3253
Do.	Hot ..	Do.	10·47	9·61	1·40	78·52	86	0·53	0·63	690	5·53	5·55	4·53	1·3	.	2·47	3779	303	905	526	3253
Water-tube	Do. ..	Do.	11·50	11·88	0·98	75·64	144	0·42	0·68	630	5·11	5·13	4·11	..	..	1·90	3779	173	709	623	3156
Multitubular .	Steam-jet	Do.	12·60	10·10	1·60	75·70	96	0·51	0·66	570	4·55	4·57	3·53	..	..	1·74	3779	303	599	608	3171
Water-tube ..	Do. ..	Do.	10·95	8·62	2·70	77·73	71	0·59	0·68	657	4·58	4·60	3·58	1·64	1·94	1·56	3779	476	632	628	3151
		Average					90·5														
								Ashpit Doors open.													
Multitubular	Cold ...	Fans ..	10·43	12·43	1·56	75·78	162·0	0·73	1·12	541	5·24	5·26	4·24	..	..	2·62	3779	303	654	605	3174
Do.	Do. ...	Chimney	9·66	10·79	1·44	78·11	108·0	0·52	0·62	630	6·10	6·12	5·10	..	..	2·64	3779	303	881	623	3156
Water-tube .	Do. ..	Do.	11·94	6·54	2·30	79·22	45·0	0·59	0·70	675	4·88	5·02	3·88	1·55	2·33	1·27	3779	428	536	633	3146
Do.	Do . .	Do.	12·80	11·80	2·20	73·20	154·0	0·49	0·68	675	4·02	4·03	3·02	..	..	1·83	3779	346	751	633	3146
		Average					117·0														
								Fire Grates as for Coal.													
Lancashire ..	Cold ...	Chimney	9·20	11·41	1·96	77·43	125·0	0·47	0·53	675	6·82	6·84	5·52	..		3·24	3779	519	1153	633	3146
								At Chimney Base.													
Multitubular .	Cold ...	Fans .	7·70	13·50	1·50	77·30	182·0		1·12	497	7·25	7·27	6·25	..	.	3·48	3779	432	800	592	3187
Multitubular and Water-tube .	Cold and Hot	Chimney	10·48	7·98	2·46	79·08	63·0		0·58	675	5·29	5·31	4·29	..	.	1·66	3779	523	903	633	3146
Water-tube .	Steam-jet	Do.	11·77	9·33	2·23	76·67	84·0	.	0·68	630	4·55	4·56	3·55	..	..	1·62	3779	410	707	623	3156
		Average					109·6														
		Average over all					105·0														

The total average loss due to Columns 19 and 20 = 36 per cent.

The results of these trials are given in Table II.

In simple furnaces not fitted with air-heating chambers the air required for combustion is admitted through the ash-pit doors. With the ash-pit doors closed, the only inlet for air, excepting leaks in the brickwork, would be through the feed-hopper with the fuel.

Conclusions.—From the results of the trials described in the foregoing, the author draws the following conclusions:—

(1) The depth of fuel upon the grate, varying between 1 foot and 4 feet, offers such obstruction to the admission of air that, following the line of least resistance, the bulk of the air admitted enters through the feed-hopper with the megass. The author has frequently seen step-grates covered with fine black ash, which to all appearance was perfectly dead, there being no movement from inward flow of air, whilst above the ash the megass was burning with an intense heat.

(2) The present system of grate and hopper permits of the admission of excess air, whilst affording no means of checking or regulating it. Megass, after falling an average height of 8 feet into the wagons, has a bulk of 16 cubic feet to 1 cwt.; being fibrous it does not pack closely, and air spaces are numerous.

(3) A sufficiency of air for complete combustion of the megass is carried through the furnace into the fire-hopper with the fuel.

(4) A down-draught grate would prevent the admission of excess of air by affording no other inlet than that through the thick bed of fuel upon the grate.

(5) Induced mechanical draught would afford a means of regulating the intensity of the draught at will, to suit the thickness of the fuel upon the grate and the quantity of air required for proper combustion.

TABLE II.—RESULTS OF THREE TRIALS OF A MEGASS FURNACE ATTACHED TO A BABCOCK AND WILCOX WATER-TUBE BOILER.

Heating surface, 4780 square feet. Superheating surface, 452 square feet. Grate-surface, 50·66 square feet.

Height of chimney, 120 feet. Diameter of chimney, 6 feet 6 inches.

Trial A. Air for combustion passed through heating-chambers, ash-pit doors closed.

,, B. ,, ,, supplied by steam jet-blower; ash-pit doors closed; air-chamber sealed.

,, C. Cold air for combustion supplied through open ash-pit doors; air-chamber sealed.

Analysis of Fuel.

Contained sugar	7·85 per cent.
,, water	48·81 ,, ,,
,, fibre	42·00 ,, ,,
Other solids	1·34 ,, ,,
Gross thermal value	3,779 B.Th.U.
Carbon contained in 1 lb. of fuel	0·261 lb.

			Trial A.	Trial B.	Trial C.
1.	Fuel burned per hour	Lbs.	4,261	5,440	6,840
2.	,, ,, per square foot of heating surface	,,	0·89	1·14	1·43
3.	,, ,, ,, ,, ,, grate ,,	,,	84	107	135
4.	Temperature of feed-water	°F.	82	82	82
5.	Water evaporated, actual	Lbs.	6,507	8,867	7,795
6.	,, ,, per square foot of heating-surface	,,	1·36	1·855	1·63
7.	,, ,, per pound of fuel	,,	1·527	1·630	1·400
8.	,, ,, ,, ,, dry fuel ..	,,	2·983	3·183	2·226
9.	,, ,, per pound of fuel from and at 212° at temperature of superheated steam ..	,,	1·835	1·979	1·638
10.	Flue-gas analyses (volumetric)	CO_2	9·55	10·95	11·94
11.	,, ,, ,, ...	O	11·05	8·62	6·54
12.	,, ,, ,, ...	CO	2·25	2·70	2·30
13.	,, ,, ,, (by difference)	N	77·15	77·73	79·22
14.	,, ,, Excess of air $\dfrac{N}{N - \frac{79}{24} O}$	Per cent	117	71	45
15.	,, ,, Chimney-draught at back of boiler in inches of water ..		0·59	0·59	0·59
16.	,, ,, Temperature of gases leaving boiler.. ..	°F.	652	657	675
17.	Air consumed. Weight of air admitted for combustion, by anemometer at 82° F.	Lbs.	1·52	1·64	1·55
18.	,, ,, Weight of air through firing hopper and leakages at 82° F.	,,	4·08	1·94	2·33
19.	,, ,, Weight of excess air admitted into furnace at 82° F.	,,	3·02	1·56	1·21
20.	Absolute pressure in boiler	Lbs. per Sq. In.	84·8	117·0	114·4
21.	Steam, degrees of superheat	°F.	75	90	85·5
22.	Heat-balance. B.Th.U. contained in 1 lb. of fuel ..		3,779	3,779	3,779
23.	,, ,, Transferred to water in boiler	B.Th.U.	1,772	1,911	1,638
24.	,, ,, Loss by incomplete combustion	,,	497	476	428
25.	,, ,, Carried away by flue-gases	,,	570	632	536
26.	,, ,, Carried away in evaporating contained water ..	,,	630	628	633
27.	,, ,, Loss by radiation unaccounted for and error ..	,,	310	132	544
28.	,, ,, Net thermal value of 1 lb. of fuel, line 22—line 26	,,	3,149	3,151	3,146
29.	,, ,, Loss on net thermal value by lines 24 and 25.. ..	Per cent	34·0	35·2	30·3
30.	,, ,, Loss on net thermal value from lines 24, 25, 26, and 27	,,	63·7	59·6	67·9
31.	,, ,, Efficiency	,,	63·3	63 6	51·5

THE ESTIMATION OF CANE CROPS.

By C. R. Hamakers.

In the Argentine, where such large quantities of cane are *purchased*, and much depends upon the quantity to be obtained from the area under cultivation, it is of considerable importance to be able to know beforehand as nearly as possible what amount will be obtained from each field.

In Java the estimates are generally made a short time before the beginning of the season, and the *ingenio* proprietors or other persons interested in the mills are supplied with a list containing the probable cane production.

However as the season advances these figures nearly always require to be altered considerably; one year they are excessive, another year greatly underestimated. Even experienced people who for long years have been regularly engaged in calculating the cane crop make these mistakes. No doubt they cannot help it, but all the same it is amusing to hear the excuses offered when they are wrong,—always of course a certain animal pest, disease, or climatic influence has been the fault.

I started a couple of years ago to take up this work and sought for a basis on which to make my calculations. I ordered the superintendents of three mills under my control, situated in different districts of Java, to take measurements and weights of the cane stalks in the way indicated below and as frequently as the time at their disposal would allow. During one season I got more than 100,000 cane stalks examined in this way.

I very quickly found that the reason for the errors in the calculations of so many experts was to a great extent nothing more than the varying diameter of the cane stalk. As will be seen below, the difference in grams for every mm. in diameter per meter of length of cane amounts to about 40 for the *Cheribon*, which is nearly the same as the kind of red cane that we are planting in Argentina. Accepting a length of 2½ meters, the difference for 1 mm. extra diameter will amount for every stalk to 100 grams, and allowing 70,000 stalks per hectare, will attain the appreciable amount of 7000 kg. per hectare, or for an area of 1500 hectares 10,500 metric tons.

This is only for 1 mm. difference in diameter; and what is 1 mm. or even 3 mm.? They cannot be observed with the naked eye, and are only to be detected by careful measurement.

I therefore started my experiments with a view to getting a more accurate, scientific, and yet simple method of estimating the amount

of cane, and one more nearly corresponding to the actual than has hitherto been the case.

In the first place, we had to decide where the average diameter of the cane should be measured, and it was found that on taking diameters all over the stalk and finding their average, a figure resulted which was equal to that of the diameter taken in the middle of the stalk.

I accordingly gave instructions to cut off pieces of the stalk exactly one meter in length, half a meter on each side of the middle, and to weigh them. As there were different cane varieties on these estates, measurements and weights were taken of every species. The figures obtained were as follows, being averages of about 100,000 stalks.

Cane Varieties.	Weight in grams of 1 meter cane, per mm. dia.												
	20	21	22	23	24	25	26	27	28	29	30	31	32
Cheribon	331	362	416	434	491	528	560	595	666	689	728	777	781
Djamprok	357	365	401	440	467	508	558	587	612	621	634	..	..
Fidji	..	..	..	..	..	..	..	..	599	674	708	743	810
Black Manilla	373	387	417	472	489	535	555	605	619	643	687	..	..
Yellow Stripped Batjan	346	379	415	434	457	497	513	..	..	..	..	..	..
Seedling A	340	377	412	459	498	536	560	573	634	641	652	717	756
Seedling No. 33A	372	409	425	450	481	502	557	582	589	..	..	..	..
Seedling No. 100	..	..	..	454	479	515	552	569	574	642	670	721	844
Seedling No. 155	..	..	..	.	466	518	577	611	652	688	752	..	..
Muntok..	358	368	401	413	451	508	551	603	648	675	728	.	..

It was a pity that I could not continue this work as I shortly afterwards left Java. If continued a couple of years more over a large area of canes, it would have given definite figures and could easily have been combined in a small pocket-book, indicating directly the quantity of cane to be obtained from one hectare by a certain number of stalks of given diameter and length.

The second experiment was to see how we could ascertain the average stalk diameter of a field of cane, and Prinsen Geerligs, whom I asked to help me in that part of Java where his experiment station was situated, was so kind as to communicate to me the following results.

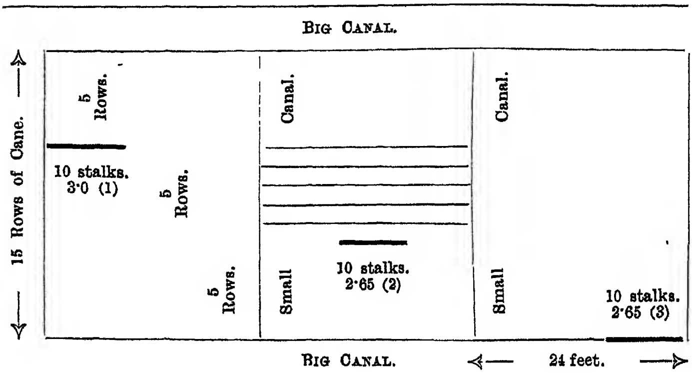
The accompanying Table represents a canefield of about 1 hectare in area, which is cut up into 100 rectangles by intersecting irrigation canals, represented in the Table by the horizontal lines *a*, *b*, *c*, *d*, and vertical lines *m*, *n*, *o*, *p*. In each of these rectangles (24 feet in length and containing 15 rows of canes) the diameter of ten adjacent cane-stalks were measured in centimetres, so that, over the whole area, no less than 1,000 stalks were examined.

I.	3·—(1)	2·65 (2)	2 65 (3)	2·65 (4)	2·60 (5)	2·70 (6)	2·75 (7)	2·50 (8)	2·60 (9)	2·50 (10)	*a*
II.	2·80	2·60	2·65	2·60	2·60	2·50	2·70	2·65	2·70	2·60	*b*
III............	2·75	2·55	2·70	2·45	2·60	2·60	2·60	2·45	2·45	2·50	*c*
IV.	2·55	2·60	2·45	2·35	2·80	2·60	2·70	2·55	2·40	2·30	*d*
V.	2·25	2·30	2·55	2·65	2·45	2·80	2·55	2·55	2·50	2·45	
VI.	2·45	2·15	2·50	2·45	2·55	2·50	2·65	2·35	2·50	2 35	
VI.	2·50	2·35	2·55	2·55	2·70	2·60	2·45	2·55	2·65	2·40	
VIII.	2·25	2·50	2·55	2·45	2·50	2·50	2·40	2·45	2·30	2 55	
IX.	2·60	2·30	2·45	2·40	2·55	2·70	2 45	2·55	2·35	2·30	
X.	2·70	2·30	2·60	2·55	2·50	2·70	2·50	2·60	2 55	2·55	
	m	*n*	*o*	*p*							

a, *b*, *c*, *d*, &c., are big irrigation canals, after each 15 plantrows.
m, *n*, *o*, *p*, &c., are small irrigation canals of about 1½ feet (24 feet apart).

Only the average diameters of every ten canestalks are recorded in the Table; thus, on line I. we find that ten stalks showed an average diameter of 3·0 centimetres in the first rectangle (1), 2·65 cm. in the second rectangle (2), and 2·65 in the third rectangle (3). In each case the group of ten canestalks occupied different positions within the rectangles (1), (2), and (3), as shown on an enlarged scale below.

ENLARGED SKETCH OF THREE RECTANGLES FROM TABLE.



This grouping is repeated in rectangles (4), (5), and (6), and again in (7), (8), and (9), as also on every line in the Table; and from the figures thus recorded, the average diameter for the whole area was found to be 2·53 cm.

Next, in order to ascertain whether a fair average could be deduced without measuring so many stalks, we omitted certain vertical columns and horizonal lines from the Table and averaged the remainder, for example:—

		Averages.
1.	Alternate vertical columns (1, 3, 5, 7, and 9) gave . ..	2·57
2.	Vertical columns (1, 5, and 9) gave..	2·55
3.	Alternate horizontal lines (I., III., V., VII., and IX.) gave	2·58
	,, ,, ,, (II., IV., VI., VIII., and X.) gave	2·52
4.	Horizontal lines (I., IV., VII., and X.) gave	2·64
	,, ,, (II., V., and IX.) gave	2·45
5.	,, ,, (I., V., and IX.) gave	2·56
	,, ,, (II., VI., and X.) gave..	2·56
	True average (as found above)	2·53

It will be seen that, omitting the fourth averages, the difference between the *approximate* and the *true* averages does not exceed ·05 (½ millimetre), and consequently that a fair average can be deduced from a very small number of measurements in each canefield.

To apply this system in practice, the number of canestalks per hectare is similarly estimated by counting the stalks in a few of the 24-foot plantrows. The average height (or length) of the stalks must also be measured at a point where the stalks are erect. In this way it would be possible to obtain a fairly accurate estimate of the weight of the crop.

In Argentina, where the red cane is the staple variety, we take as many measurements in the field as is practicable, and the estimated yield per hectare agrees very closely with that of the Cheribon cane in Java. The same plan might be adopted for the varieties of canes grown in other countries.

Carlos R. Hamakers.

Argentina.

THE HUILLARD DRIER AND ITS APPLICATION TO DIFFUSED MEGASS AT THE USINE ESTHER (BRAZIL).

By M. Leroy.

The Usine Esther is situated in the State of São Paulo (Brazil), and was erected in 1905 by the Fives-Lille Company, being specially designed for the direct diffusion of the cane. The usine is capable of treating 160 tons of cane in 22 hours, and is provided with a battery of 16 diffusions of 22 hectolitres capacity, arranged in two parallel lines.

Without entering into details, it is sufficient to state that the canes are passed through a slicing machine which reduces them to chips of 2 mm. in thickness. These chips then enter the diffusion battery, where they are subjected to repeated extractions until they are almost completely free from sugar. As discharged from the diffusers, the exhausted chips have the following composition:—

	Per cent.
Water	88
Solid Matter	12
	100

The chips are then passed through a mill which extracts a portion of the water, leaving a megass containing:—

	Per cent.
Water	70
Solid matter	30
	100

In this condition the megass is of little value as fuel on account of its high water-content and low sugar-content; in fact, it will not burn satisfactorily in the usual type of megass furnace. Only by

employing the Godillot furnace has it been possible to obtain a satisfactory combustion and to utilize about 50 per cent. of the megass, though with much difficulty owing to sudden demands for steam which occur during the routine work of the factory.

The solution of this problem consists, then, in extracting the greater part of the contained water from the megass, an operation which was formerly effected either by sun-drying the megass, or by means of supplementary mills. The former method, besides necessitating considerable manual labour, is not equally applicable in different countries and is quite unsuited for Brazil where the rains are very frequent. The installation of a second mill represents a considerable expense, to which will be added the cost of fuel to furnish the additional engine with steam.

The economic solution of this problem has, therefore, remained a veritable stumbling-block to the diffusion of cane until a few years ago, when M. A. Huillard proposed to utilize the waste gases from the furnaces for this purpose. The first apparatus, designed on this principle and applied to the diffusion of cane, was erected in a sucrerie in the State of Rio de Janeiro, Brazil, and was then successively adopted in Egypt, Spain, Brazil, Italy, and France. Nor was it confined to the sucrerie, but was applied in numerous industries in which the residual products were used as fuel, the calorific value of which could be improved by simple drying.

An excellent description of the Huillard Drier having been already published in the *Bulletin de l'Association des Chimistes* for February, 1906, by M. Lafforque, we shall be content with a brief exposition of the movements of the material under treatment. In the case now under consideration, the diffused megass arrives at the top of the Drier; the apparatus itself having the form of a circular tower, the dimensions of which vary according to the quantity of material to be dried in a given time. At the Usine Esther, where 160 tons of cane are treated in 24 hours, the tower is 8 metres high and 2½ metres internal diameter.

On entering the top of the Drier, the megass passes down a chute provided with valves to prevent the entrance of air, and thence falls upon the first horizontal partition near the circumference of same. It is here distributed by a revolving rake which gradually draws it towards an outlet in the centre of the partition whence it falls upon a second partition, and so on, until it finally arrives at the ground level, whence it is removed by a carrier and conveyed to the furnaces.

The hot gases leaving the boilers are drawn upwards through the Drier by a fan situated at the top of the tower, and as these gases pass from platform to platform they become more and more charged with water vapour abstracted from the megass and are finally discharged from the fan either through a special chimney or through the chimney belonging to the boiler range.

The gases enter the Drier at a temperature of about 250° C. and escape at top in the form of a dense white cloud, having a temperature which varies between 50° and 60° C.

Such being the essential features of the drying process, we will now return to the megass which we left passing through the mill and which reaches the Huillard Drier with a water-content of 70%. During exposure to the hot gases a large proportion of this water is evaporated, so that the megass emerging from the Huillard Drier has the following composition:—

	Per cent.
Water	35
Solid matter	65
	100

In this condition the megass passes to the Godillot furnaces and burns perfectly, producing a quantity of steam which may be calculated as follows:—

First, as regards the weight of dried megass obtained per ton of cane. Assuming that every ton of cane yields 1,000 kilos of wet chips containing 88% of water and 11% of fibre, there will be obtained, after milling, $\frac{100\times11}{100-70}=36{\cdot}66$ kilos of megass containing 70% of water per 100 kilos of canes treated. After passing through the Huillard Drier, there will be $\frac{100\times11}{100-35}=16{\cdot}9$ kilos of megass, containing 35% of water.

This final megass, containing about 2·6% of sugar, will evaporate about $2\frac{1}{2}$ times its weight of water at 70° C., which represents:—
$169\times2{\cdot}5=422{\cdot}5$ kilos of water converted into steam per ton of cane.

Economy in Fuel.

1. In a factory equipped with quadruple effet and utilizing the hot condensed waters in the battery, with a dilution of about 18%, the quantity of steam required will not exceed 800 kilos per ton of cane.

As the dried megass furnishes 422·5 kilos there is a deficit of $800-422{\cdot}5=377$ kilos, which must be furnished by wood. Wood, of average quality, is capable of evaporating three times its weight of water at 70°, so that $\frac{377}{3}=125$ kilos of such wood would be required Assuming, further, that a ton of wood costs 10 francs delivered at the factory, the cost of this supplementary fuel will amount to 1·25 francs per ton of canes treated, or 25,000 francs for a campaign of 20,000 tons.

2. We will next consider the case of a factory working the diffusion process under precisely similar conditions, but without the Huillard Drier; the exhausted cane chips being merely passed through a mill. As in this case only half of the megass produced could be utilized in the Godillot furnaces, there would be only $\frac{366}{2}=183$ kilos available.

This contains 70% of water and, assuming that it is capable of evaporating its own weight of water, it would furnish 183 kilos of steam. The deficit, in this case, would be $800-183=617$ kilos, which would have to be made good by $\frac{617}{3}=205$ kilos of wood. The cost of this would be 2·05 francs per ton of cane, or 41,000 francs during a campaign of 20,000 tons.

To sum up, the supplementary fuel costs 25,000 frs. when the megass is milled and subsequently dried in the Huillard Drier, but amounts to 41,000 frs. when the megass is milled only. The advantage of the Huillard Drier may, therefore, be represented by 16,000 frs. during a campaign of 20,000 tons, which, in the course of two years, would cover the price of the Huillard apparatus and the cost of erection.

Supplementary Note.

It may be of interest to indicate the economic advantages of the Huillard apparatus in the case of a factory extracting the juice by double crushing with maceration (12% dilution) and equipped with triple effet without re-heaters. With good boilers and Godillot furnaces, the consumption of steam should not exceed 600 kilos per ton of cane.

Supposing that 280 kilos of megass (containing 50% of water) are produced per ton of canes ground, the quantity of steam furnished by this fuel will be equal to—

$$280 \times 1{\cdot}8 = 504 \text{ kilos,*}$$

which leaves a deficit of $600-504=96$ kilos of steam, requiring $\frac{96}{3}=32$ kilos of wood.

By means of the Huillard Drier the above-mentioned 280 kilos of megass would be reduced to 215 kilos containing 35% of water, and furnishing

$$215 \times 2{\cdot}8 = 602 \text{ kilos of steam,}$$

a quantity which would be sufficient for all requirements. The economy effected would therefore be represented by 32 kilos of wood per ton of cane, or 6,400 frs. during a campaign of 20,000 tons.

Note by M. H. Pellet.

We would like to make the following observations. :—

As regards the statement that megass containing 35% of water will evaporate $2\frac{1}{2}$ times its own weight of water at 70° C., and that 100 kilos of cane yield 16·9 kilos of megass, containing 11 kilos of fibre, which furnishes 422·5 kilos of steam. Admitting that ordinary coal will evaporate 8 times its weight of water, the supplementary fuel would then be represented by 53 kilos of coal per ton of cane, a figure which closely approximates to practical experience.

* The evaporating powers of megass, containing 50 and 35% of water, are represented by the coefficient; 1·8 and 2·8, according to M. Bouvier, in an excellent memoir, which appeared in the *Bulletin* for June, 1906.

The calorific value of megass cannot be established theoretically, but must be determined under actual working conditions, that is to say, with the furnaces at one's disposal. Having studied this subject during the past 12 years, we have found that the evaporating power of megass varies considerably according to the manner in which it is burned and the type of furnace used. Theory furnishes certain general indications, but fails to distinguish the best qualities of megass. Consequently, 1 kilo of megass may evaporate 2 litres of water under certain conditions, whilst under particular conditions it may be capable of evaporating 3 or 3½ litres.

Certain phenomena take place in the furnaces which are analogous to those which occur in the Huillard Drier, and which explain the occasionally high evaporating power of the megass. In this connection we have made numerous experiments, the result of which we hope to publish in a memoir dealing with the fuels used in cane-sugar factories.

We would also remark that the proportion of fibre in the cane is very variable. If, in certain countries, it amounts to 10 %, in others it is 11 %, and in Java it has been found to run as high as 13·5, 14, and even 14·8 %. Under such conditions it is easily understood how the megass suffices for steam-raising purposes without requiring to be supplemented by wood or trash. Indeed, sometimes there may be a surplus of megass.

We have ourselves analysed canes containing 16·6 of fibre, and Mr. Prinsen Geerligs has met with particular species of canes containing 17 and 18 % of fibre, and said to be very hard. Such canes are very advantageous in economising fuel, and equally so as regards the extraction of the juice by milling, the megass retaining less residual juice. If, in addition, they are of average richness, they should be preferred.

As regards the efficiency of the Huillard Drier, it has been found that the best results are obtained under special conditions. Consequently the apparatus must be carefully studied in all its parts, as also the variations in temperature and pressure, before it can do the maximum work of which it is capable, and which greatly exceeds the average efficiency of the same apparatus.

Special information will be given later concerning a series of new experiments with this apparatus which are being made in Egypt.—(*Bulletin des Chimistes.*)

The prospects for a central beet factory at Sleaford, Lincolnshire, are considerably improved by the announcement that a German machinery firm have written offering to invest a large sum in the undertaking. It seems, however, undesirable that foreign capitalists should be allowed to acquire a commanding interest in this purely British scheme.

THE IMPROVEMENT OF THE SUGAR CANE BY SELECTION AND HYBRIDIZATION.*

By Sir Daniel Morris, K.C.M.G., and F. A. Stockdale, B.A.

(Continued from page 245.)

II.

Some Results Already Obtained.

India.

Efforts to improve the sugar cane in India have only recently been made. With the establishment of the Samalkota Sugar Station in Madras the cultivation of the cane under Indian conditions is being carefully studied. Several varieties of canes have been introduced from other countries, including Mauritius and Barbados, with good results.

One of the imported Mauritius canes was a ribbon cane called Striped Mauritius, and Barber, in his report on the station for 1904-5, states that this cane has given rise to bud varieties, red and white sports being produced. These sports have been carefully grown and analysed, with the result that the red sports have proved better than any other canes that are grown at the station in respect to richness of juice.

In 1903-4, a number of canes arrowed at the station, and an effort was made to obtain cane seedlings, but without success.

Although previous to this time repeated mention of cane seed has been made in different parts of India, no record of the seed being fertile seems to have been reported.

Barber states that these experiments with cane arrows were directed mainly towards the investigation of whether the sugar cane produced fertile seed in India. This has therefore been shown to be the case, but it is thought that the burning dry air of the Indian climate is unsuitable to the successful raising of seedling canes, and that the cultivation of sports appears to be much more practical than the raising of seedling canes. The raising of hybrid canes, however, would possibly be a means of combating many of the diseases that cause so much trouble to cultivators of sugar cane in India.

Queensland.

The raising of cane seedlings has received some attention in Queensland, as reports to hand state that nine seedlings were obtained from arrows collected in 1889, and five from those collected in 1891.

In 1900, a selection of West Indian seedling canes was imported, with the result that last year some gave analyses which compared very

* This paper was presented to the Conference on Genetics held in London in August, 1906, under the auspices of the Royal Horticultural Society.

favourably with the home seedlings, while the information gathered from the latest reports confirms the value of B. 208 as a cane for cultivation in Queensland.

In 1901, there were obtained by the Queensland Acclimatization Society 700 seedlings, of which 300 were approved plants, and, in 1903, 170 plants were selected out of 500.

In 1904, experiments in artificial cross-pollination were undertaken and four hybrids were obtained. These were the results of a cross between B. 208 as seed-bearing parent and Striped Singapore as pollen-bearing parent.

In 1903, only one cane gave over 19 per cent. possible obtainable cane sugar, whereas, in 1904, six exceeded this amount. How much this had to do with the season cannot be stated definitely, but it seems to point to the fact that in Queensland, as elsewhere, seedling canes may gradually supplant the older varieties.

Grimley states that B. 208 on one estate gave a "return of 69 tons 6 cwt. of cane per acre with 22·2 per cent. of sucrose, and Brix 23·09 or 21·45 per cent. of possible obtainable cane sugar, or over 14 tons to the acre. These results were obtained under irrigation, and the experiment plot was well manured. The average yield in Queensland per acre for the last seven years was 13·16 tons, so that B. 208 gave more sugar per acre than the average tons of canes per acre in Queensland."

Hawaii.

With the establishment of the Hawaiian Sugar Planters' Association the propagation of new varieties of canes, which are resistant to disease and at the same time good sugar producers, was considered to be of paramount importance.

In the season 1904-5 no young canes were obtained from the home-grown seed, but large numbers of seedlings were obtained from seed introduced from Barbados, Jamaica, and Trinidad. In all, 279 seedling canes were obtained and planted out; ninety-three of these were cut up and replanted as cuttings, while the remainder were allowed to remain to flower, when it was hoped that a considerable quantity of fertile seed would be obtained.

The introduction of foreign varieties is largely practised, seedlings from Demerara, Barbados, and Queensland have been introduced, and it is stated that "D. 117 holds the lead among the recently introduced varieties and is a promising cane worthy of trial under the diversified conditions of the island." Among other very promising seedling canes are B. 147, B. 156, B. 208, D. 145, and Q. 1.

Louisiana.

Owing to the shortness of the growing season, which is limited to about eight months on account of frosts, the home canes in Louisiana rarely arrow. Seedlings from these home canes have not been obtained, and therefore planters have to rely upon imported varieties.

Seedling canes from Demerara, Barbados, Jamaica, and Queensland have been imported, and submitted to trial at the Experiment Station. A large number were found to be unworthy of recommendation to the planters, others are still under experiment, and two of the Demerara seedlings, viz., D. 74 and D. 95, have surpassed all the home canes.

D. 74 is a tall, green, erect cane with long internodes, long and deep roots, ratoons well, and has a large sugar content. The individual canes are large and heavy.

D. 95 is a large, purple, erect cane with long internodes, long and deep roots, ratoons well, has a large sugar content, and large individual stalks.

Blouin reports that both these canes are very hardy, mature early, and that their erect habit renders them better able to withstand storms and makes them more easy to harvest.

During 1905, D. 74 arrowed in Louisiana, this being the first seedling that has flowered in that State.* From this it may be inferred that this cane is one which quickly matures. If it matures while the other varieties remain immature, and gives a high sugar content, it should prove to be a valuable cane to sugar planters in Louisiana. The planters fully appreciate the value of these varieties, as it is estimated that nearly four-fifths of them have introduced one or both of the Demerara seedlings into their cultivation, and, if these canes continue to flourish, nearly two-thirds of Louisiana's cane area will be planted with them in two or three years' time.

Mauritius.

A large number of varieties of canes are grown in Mauritius, amongst which are two sports of the Striped Tanna which have been submitted to extensive trial.

Seedlings were successfully raised shortly after the discovery of fertile seed in Java and Barbados, a large number of which were distributed to estates. These seedlings gave such good results that managers frequently started seedling nurseries of their own, and much confusion in nomenclature followed.

It is also interesting to note that, as early as 1889, a method of what may be called natural hybridization, by which several hybrids have been obtained in the West Indies, was fully discussed by Boname, but was thought to be impracticable on a field scale. It was suggested that the inflorescence be enclosed in muslin bags when quite young and then the inflorescence of another be introduced when its flowers were ready for pollination. No record can be found of this method being practised in Mauritius.

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* Since this paper was written, it has been announced that seedling canes have been successfully raised for the first time in Louisiana.

JAVA.

The raising and cultivation of seedling canes have been taken up to a considerable extent in Java, on account of their comparative freedom from disease. After the discovery of fertile seed of the sugar cane in 1887, many of the larger planters cut the cane arrows, planted them, and raised large numbers of seedling plants. From these they selected such as had a high saccharine content and showed themselves able to resist disease for planting on a large scale, and then finally selected those which were best suited to their estates.

Owing, however, to the insufficiency of the trials before introduction into the general cultivation, much distress was incurred, and therefore planters began to look to the Experiment Stations for selected seedling canes.

In 1894, Wakker, the Director of the East Java Experiment Station, discovered that the Cheribon cane bore infertile pollen, while the ovary was normal. Bouricius crossed the Cheribon with the Fidji, and later Kobus crossed it with the Chunnee, one of the imported East Indian canes, for this showed a large proportion of fertile pollen. The two chosen varieties were planted alternately in rows in order to obtain natural cross-pollination. A very large number of seedlings was obtained by sowing seeds from the "self-sterile" arrows of the Cheribon, many of which combine the high sugar content of the Cheribon with the disease-resisting power of other selected varieties.*

All the resulting seedlings are tested in the station for four years before being recommended for general cultivation. In this way a race of hardier canes has been established, and the sugar content has not been noticeably decreased, although one of the varieties used as a parent was rather low in percentage of saccharose.

The choice of the Chunnee variety as one of the standards to be used for crossing purposes has even been more valuable than the experimentalists dared at one time to hope, for all the seedlings at the Experiment Stations that are the descendants of the Chunnee are less subject to root disease, as well as to other maladies. They are, however, somewhat hard, which is an inconvenience for crushing purposes, but it is not thought that this property is undesirable, as it is counterbalanced by others that are useful.

Efforts are now being made to raise other races of plants, one—a more hardy race of seedlings—by crossing those seedlings already obtained with the immune variety Chunnee, and the other—a richer race of seedlings—by crossing seedling canes with the Cheribon, and also with other seedlings.

Many of the seedling varieties already obtained have given an estimated yield of sugar per acre of about double that given by the old standard variety.

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* In 1905, over 16,000 seedlings were raised at the East Java Experiment Station. Of these, the parentage of 7,170 was known on both sides, for they were produced by the above method, and that of 7,400 others was known on one side only.

Cuba.

Experiments have been conducted with the introduction of standard varieties and seedlings from Java, Queensland, and the British West Indies. After considerable testing, many of these are being introduced into the general cultivation. B. 208 has been giving excellent results both in percentage of saccharose and purity of juice.

Four years of careful hybridization resulted in but two seedlings, but during the last year (1905-6), owing to a favourable season, over 600 seedlings have been obtained by Atkins at the Harvard Experiment Station, and nearly all of these are the result of hand cross-pollination. Emasculation was effected during early morning when the anthers were full-grown but unexpanded, and pollination was continued for several days, the spikelets being kept under gauze cloth. It is moreover shown in his report, that great care must be taken with the germination of the seeds, much depending upon the soil used, on the depth to which they are set, and on the watering.

British West Indies and British Guiana.

Since the establishment of the fact in 1887 and 1888, by Soltwedel in Java and Harrison and Bovell in Barbados, that the sugar cane at times does bear fertile seeds, systematic attempts have been continued in the West Indies and British Guiana towards the raising of improved races of seedling canes, with results which will be found detailed below. It should be observed that the "Bourbon" cane was at one time the standard cane of the West Indies, but owing to fungoid diseases, its cultivation had to be given up, and other varieties substituted in its place. In Barbados the cultivation of the Bourbon cane has been entirely abandoned, and another variety, the White Transparent, has taken its place as the standard cane.

Barbados.—Thousands of seedlings are raised yearly in Barbados from the planting of the arrows from the better varieties, and these are submitted to rigorous selection on the tonnage of canes per acre and the chemical analysis of the juice. During the last five years in Barbados over 20,000 seedling canes have been raised and planted out, but less than 1 per cent. of these have stood the stringent tests of field and chemical selection applied to them. In the season of 1904-5 over 7,000 plants were raised from seed, and out of these only ninety-five were considered worthy of further propagation. It may be urged that a large number of seedlings are in this way wasted every year, but it is held by Bovell that, owing to the limited extent of the experimental grounds, it is necessary to limit the cultivation to seedlings that give an estimated yield of 30 tons of canes per acre and a saccharine content of over 18 per cent.

Work on these lines has been continuously pursued in Barbados since about 1888, and the following table of results, extracted from the reports recently issued by d'Albuquerque and Bovell on the

experiment work with sugar cane, under the direction of the Imperial Department of Agriculture, show that many of these seedling canes give results vastly superior to the standard variety :—

TABLE I.—MEAN RESULTS—BLACK SOIL—FOR SEASONS 1900-5.

Cane.	Canes. Tons per acre.	Per cent. of rotten canes.	Saccharose. Pounds per gallon.	Quotient of purity per cent.	Saccharose. Pounds per acre.	Muscovado yield. Tons.
B. 1529 (1904-5)....	28·92	1·54	2·406	92·18	8,477	3·03
B. 147 (1900-5)..	28·35	3·77	1·912	86·88	7,006	2·50
B. 208 (1900-5)....	24·72	4·93	2·250	90·70	6,863	2·45
White Transparent (1901-5)..	25·22	5·99	2·038	89·70	6,453	2·30

TABLE II.—MEAN RESULTS—RED SOIL—FOR SEASONS 1900-5.

Cane.	Canes. Tons per acre.	Per cent. of rotten canes.	Saccharose. Pounds per gallon.	Quotient of purity per cent.	Saccharose. Pounds per acre.	Muscovado yield. Tons.
B. 1529 (1904-5)..	27·12	1·67	2·270	93·79	7,428	2·65
B. 208 (1900-5)....	26·78	5·52	2·146	91·23	6,695	2·39
White Transparent (1901-5)..	22·24	4·93	1·979	90·09	5,404	1·93

It has often been urged that these results are based upon small plots, which do not furnish a sufficient quantity of cane for the tests to be of value to sugar planters, but tables are also given in the above-mentioned report which show that seedlings B. 147 and B. 208 are giving better results than White Transparent when grown on an estate scale.

Jamaica.—Cousins, in his report on the work of the sugar experiment station in Jamaica for 1905, states that some very good seedling canes, resulting from naturally cross-fertilized seed, have been produced and are being submitted to a rigid selection.

In the trials of the imported varieties, B. 208 yielded 65·5 tons of canes per acre, and is being recommended to planters "as the most promising seedling cane at present grown in Jamaica."

Leeward Islands.—The results recently issued by the Imperial Department of Agriculture for the West Indies on the work carried on by Watts at Antigua show that B. 208 gave an average yield of 9347 lb. saccharose per acre in plant canes and 5001 lb. in ratoons, against 7014 lb. in plant canes and 4265 lb. saccharose per acre in

ratoons of White Transparent. In St. Kitt's, B. 208 gave an average yield per acre of 8675 lb. saccharose in plant canes and 6648 lb. in ratoons, against 7014 lb. saccharose in plant canes and 5861 lb. in ratoons of White Transparent, while B. 147 gave a yield of 7133 lb. in plant canes and 6174 lb. in ratoons.

As these figures are the mean results of a large number of plots carried on for four years in plant canes and for three years in ratoons in Antigua and for five and four years, respectively, in St. Kitt's, they show that seedling canes are of considerable economic value to planters in the Leeward Islands.

British Guiana.—In British Guiana, up to the beginning of 1905, about 330,000 seedling canes had been raised by obtaining seed from good standard varieties, and 26,000 of these had been selected for field experiments. Harrison, at the West Indian Agricultural Conference of 1905 stated that 14,800 acres were under cultivation with varieties other than Bourbon, and of these about 13,000 acres were occupied by new seedling varieties, the favourite ones with the planters being D. 109, B. 147, D. 145, D. 625, and B. 208. It is estimated that D. 145 bears a ratio to the Bourbon in respect to saccharose yield per acre as 170·8 is to 100.

Trinidad.—In Trinidad experiments on a small scale have been carried on with seedling canes, and reports show that D. 95 has given an average return of 23·65 tons of cane per acre, as against an average of 21·33 tons per acre for White Transparent and 16·43 tons per acre for the Bourbon.

Hybrids in Barbados.

The experimental work begun by Lewton-Brain in 1904 in artificial cross-pollination and self-fertilization proved successful, and therefore in 1905 systematic attempts to raise new hybrids were commenced.

Crossing was performed in two directions, the pollen parent in one cross being used as the seed parent in the other cross; in other words, one variety was utilized as the female parent in one cross and as the male parent in the other.

"The arrow which was to become the seed parent was carefully selected on a cane free from disease, bagged before it began to emerge from the leaf-sheath, and allowed to remain until a length of at least 6 inches presented itself in the air and to the rays of the sun. It was found that very young spikelets were affected seriously by the sun after they had been operated upon, but that, if they remained exposed until the glumes were beginning to turn slightly red, they stood the severe handling much better. Careful microscopic examination of the flowers at this stage revealed very little mature pollen in the anthers, and the stigmata were not in a receptive condition, being still in the white, immature state. There could, therefore, be no danger of self-fertilization. It was also found that if the spikelets

happened to present a lateral view, the glumes could easily be separated, and the anthers removed without rupture."

Only those canes which had stood the strongest tests on a large scale for a number of years were used in the experiments. Over 600 spikelets were emasculated and artificially pollinated, of which over 400 were spikelets of B. 147 and B. 208.

The results of this work have not been satisfactory, as an unfavourable season with windy, showery weather destroyed all chances of good success.

Some further particulars of the results obtained by Lewton-Brain in 1904 in Barbados may be interesting. He experimented with some of the best Barbados varieties as the parent plants and as a result obtained five hybrids of known pedigree. These have been carefully grown, and although it is impossible at present to say what their commercial value will be, yet it may be interesting to record a few external features that have been noticed during the growing season.

The pedigree seedlings that have been obtained consist of the following *:—

(1) Three holes of B. H. 1;	cross between	B. 1376 × B. 1529
(2) One hole of B. H. 15;	,,	,,	B. 3289 × B. 1529
(3) One hole of B. H. 18;	,,	,,	B. 3289 × B. 1355

Description of Parents.

In the following description of the varieties used in hybridizing only the more important characteristics are noted, and are chiefly those which can be used in comparing with the descriptions of the hybrids :—

B. 1376.—Germinating power, good; colour, dull yellowish-green; habit of growth, more or less recumbent; internodes, cylindrical; eyes round; dried leaf-sheaths fall readily; disease resistance fair.

B. 1529.—Germinating power, under average; colour, red; habit of growth, upright; internodes variable but generally roundish; eyes round; dried leaf-sheaths somewhat adherent; disease resistance good.

B. 3289.—Germinating power, fair; colour, yellowish-green; habit of growth, recumbent; internodes cylindrical; eyes round; dried leaf-sheaths fall readily; disease resistance very good.

B. 1355.—Germinating power fair; colour, red; habit of growth, generally upright; internodes variable, but generally roundish; eyes round; dried leaf-sheaths fall readily; disease resistance fair.

(To be continued.)

* In the description of the crosses that gave hybrids the seed-bearing parent is always given first and the pollen-bearing parent second, thus :—cross between B. 1376 × B. 1529 implies a cross between B. 1376 as seed-bearing parent or female parent and B. 1529 as pollen-bearing or male parent.

THE FRENCH *TAXE DE RAFFINAGE.*

The *Board of Trade Journal* reproduces a recent circular of the French Customs Department, containing the increased rates of the French *Taxe de Raffinage* as fixed last February. This refining tax is levied on imported sugar and sugared products as well as on those of home consumption. The new rates are as follows:—

		Frs.	cts.
Refined sugar and sugar assimilated thereto	100 Kilogs	2	00
Sugar candy	,,	2	14
Molasses, other than for distillation, of a saccharine richness of—			
50 per cent. or less	,,	1	25
More than 50 per cent.	,,	2	00
Syrups, bonbons and candied fruits	,,	2	00
Preserves, (*confitures*) and sweet biscuits ..	,,	1	00
Sweetened condensed milk .. .. (according to the proportion of sugar.) ..	,,	0	80
		or	
	,,	1	00
		or	
	,,	2	00
Milk flour (*farine lactée*) with the addition of sugar in a proportion of—			
Less than 50 per cent.	100 Kilogs	1	00
Less than 40 per cent...	,,	0	80
Chocolate, containing 55 per cent. of cocoa or less	,,	0	90
Milk chocolate, in a liquid condition, containing at most 10 per cent. of cocoa ..	,,	0	50

On comparing these rates with those brought into force last September, it will be seen that the new ones are in most cases double the former amount; in other words, the *status quo ante* September, 1906, is generally speaking restored.

Messrs. Meyer & Arbuckle's Patent Film Evaporator, of which Messrs. Geo. Fletcher & Co., of Derby, are the sole makers, appears to be giving some good results. On an estate in Trinidad the rate of evaporation per square foot of heating surface obtained since the patent sprinklers were added to the old evaporator has been 12·7 lbs. per hour with a steam pressure in the first drum of from zero to 1 lb. This figure would have been still higher if the boiler pressure had been equal to the demand, which was not the case. Even as it is, the factory output has been raised from 270 tons to 400 tons per week. This should justify the claim advanced by the makers that the duty of many existing triples can be largely increased by the fitting of this apparatus, thus enabling the planter to enlarge his cane area without extensive additions to his factory plant.

THE ORIGIN OF NEW SUGAR CANES BY "BUD-VARIATION."

By C. A. Barber, M.A., F.L.S., Government Botanist, Madras.

One of the most striking facts connected with sugar cane cultivation is the enormous number of varieties which, though easily separable, have the greatest botanical similarity. It is frequently possible to distinguish two varieties without being able to put down clearly wherein the difference between them exists. The difference may be in the form of the joint, in the tinge of colour, in the habit of the plant in the field, in its thickness or height, in the richness of the juice expressed. Again, with no external differences at all, there may be such a difference in constitution that, whereas one cane grows clean and healthy and yields a certain crop, the other is swept out of the fields by disease.

Even after prolonged study it is difficult to decide how all these varieties have arisen. There is no doubt as to the ancient character of sugar cane cultivation. While it is probable that the cane was first cultivated in a certain Asiatic region, yet nowhere can we lay our hands on a *Saccharum*, now wild, which presents any probability of being the progenitor of the cultivated forms. The matter is not rendered easier by observing how peculiarly susceptible the sugar cane is to any change in its environment. We cannot tell beforehand in what direction changes are likely to occur, but certain it is that if two canes are taken from one part of the country to another, their characters under the new condition differ, whether in colour, form, or sugar-making properties. The pet cane of one region quickly assumes a very second rate character in another, being left behind by a cane which could in no way be considered its rival in the land of its origin. Some improve in their juice and others deteriorate, some change their colour and others do not, while some really good canes dwindle to the size of the local "reeds" which are everywhere to be found where sugar cane has long been cultivated.

With these obvious facts before us, there is an entire absence of a good connected series of observations, and we have to confess that we know next to nothing as to the way in which the countless varieties of sugar cane at the present day have arisen.

From this point of view a study of the striped canes, or those which have two main colours alternating in their stems, appears most likely to lead to interesting results. And the first subject for investigation is to try and find out how these varieties have arisen. In all likelihood the yellow or green canes were the first obtained and cultivated, and the others arose as subsequent varieties. The assumption of a red colour by the rind of plants under cultivation is by no means an

uncommon phenomenon. The striped canes would probably be the last formed, and there is some reason for supposing that each striped cane has for its parents two canes, a red and a yellow one. Such striped canes may have arisen in several ways. Firstly by seminal crossing. While seedling canes appear to be very rare in India, they are not at all uncommon in certain tropical islands; and it is fair to assume that in past times this seminal reproduction was much commoner than it is at present. The practice of growing canes of different varieties in the same field is probably very ancient, and we have a ready means by which the striped canes may have originated. That they have arisen late, among canes already cultivated, appears to be also probable from the fact that the striped canes as a whole are ones of good character from the milling point of view, and while there are numerous yellow and less frequently red canes of a reed-like primitive nature, such canes are hardly ever striped. But there is just sufficient evidence to render it possible that these striped canes have arisen from the apposition of two canes of different colours by natural grafting, and it is possible that some at least of the striped canes are in reality graft-hybrids. The general absence of grafts among monocotyledons renders this less likely but not impossible, and exhaustive experiments are called for to determine whether we may not by this method hope to raise new varieties. But the strongest argument in favour of the origin of striped canes from parents of two different colours is the not infrequent reversion of these varieties into canes of single colours. Such "sports" are by no means infrequent and form the subject of the present paper.

It is a matter of common knowledge among the Godavari ryots that in a field of *Namalu* (striped red and yellow) canes, sooner or later the number of *Keli* (yellow) canes increases. And when we take the Namalu and Keli canes and compare them from a botanical and chemical standpoint, it is difficult to find any real difference between them excepting in their colour. There is then a strong presumption that the Keli is a natural sport from the Namalu. And it may be at once asserted that the tendency in the striped canes is always to produce yellow rather than red sports, a fact which seems natural when we consider that the yellow canes are probably the older and nearer to the original cane of the primitive cultivation.

The following canes have been noted in the short life of the Samalkota Sugar Station in the Godavari district. The cane known there as the "*Striped Mauritius*" has been seen frequently to sport into green canes and less often into canes of a pure red. There are now good plots of all these canes, and they have been submitted to analysis for two years. There is no doubt that the three canes have sufficient differences, besides their colour, in the richness of their juice and in their habit of growth, to constitute well-marked varieties in the ordinary sense of the term. It is quite in accord with what

has been suggested above, that the green is the hardier, bunches more readily, and has inferior juice; that the red cane, on the other hand, is little inferior, if indeed it is not superior, to the striped, which otherwise holds an intermediate position between the other two.

The thick striped cane, called on the farm the "*Dark Striped Mauritius*," has also been identified as the parent of the yellow "*Ivory Mauritius*," but no red cane has yet been obtained from it. The long striped cane obtained from various parts of South India, called by some the "*Striped Singapore*," has sported into both red and yellow, but the characters of these have not yet been determined. Finally, the striped cane growing in Mr. Abraham Paudither's garden at Tanjore (which cane may be identical with the last named) has given rise to a new ashy cane which appears to be well worth cultivating.

This mode of origin of new cane varieties has been termed "Bud-variation." After observing the facts described above on the farm at Samalkota three years ago, my attention was drawn to an article in the *West Indian Agricultural Bulletin*, where the subject was exhaustively dealt with. No analyses were, however, published of the different canes arising from bud-variation. As in the cases noted above, it was always a striped cane which showed this phenomenon in the West Indies, Louisiana, and Mauritius. It is worthy of note that this bud-variation does not consist in certain buds growing out to form new canes of one colour, but isolated buds show *variability* and give rise to shoots of different colours, sometimes, indeed, to a shoot whose base is striped, but which becomes yellow in its upper part. The idea that a bud in the red part of a striped cane gives rise to a red cane, whereas one in the yellow part produces a yellow, is apparently not correct. The canes thus arising appear to retain their characters, and have remained constant for three or four years already.

Now this fact, that the striped canes have alone been observed to "sport," may be explained in two ways. On the one hand they may be true hybrids which have arisen from the crossing of the two one-coloured canes, and consequently may have a greater tendency to vary than the one-coloured canes. But on the other hand the frequency of the phenomenon in striped canes may be due to the fact that, while such changes in colour are very readily seen in them, they would require very careful observation in the case of ordinary canes. And I think that the latter is more likely to be the explanation. If such is the case, it behoves us to study our fields with much greater care than heretofore. Whenever, in a uniform field, canes appear which show any marked differences from the rest, they should be carefully segregated, cultivated, and analysed. A certain amount of work has been done in this direction at Samalkota, but the results

thus far obtained have not been satisfactory. Chance differences which have been observed have not been maintained. But this is no reason why the subject should be dropped, and observations will be continued as opportunity offers.

With reference to the *Striped Mauritius* and its "*sports*," the more important figures in the two years' analyses have been reproduced in the table. The *Green Sports* may be classed as a cane distinctly inferior to the other two, whereas the *Ivory* appears to be distinctly better than the *Dark Striped*. The *Red Sports* during the first year showed such good results that it was thought that a new cane of great value had been discovered. It was accordingly named the "*Gillman*," after the Collector of Vizianagram, through whose energy and forethought these Mauritius canes had been introduced into Madras. These canes and others obtained in the future will be multiplied, and, in due course, valued and added to those on the farm, or rejected, according as they turn out.

Analysis of Striped Canes and Sports in the Government Sugar Cane Farm, Samalkota.

Varieties.	Juice.	Juice.	Juice.	Juice.	Bagasse.
	Corr Brix.	Per cent. Sucrose.	C.-P.	Per cent. Sucrose.	Per cent. obtained by crushing.
Striped Mauritius, 1904-1905	20·44	19·33	94·57	·30	37·23
,, ,, 1905-1906	21·31	19·94	93·57	·67	37·53
Green Sports, 1904-1905	20·29	18·66	91·96	·60	33·92
,, ,, 1905-1906	18·57	16·61	99·45	·93	34·79
Red Sports, 1904-1905	21·35	20·23	94·75	·30	39·67
,, ,, 1905-1906	20·16	18·88	93·65	·67	34·48
Dark Striped Mauritius, 1904-1905 ..	17·06	13·98	81·94	1·54	36·87
,, ,, 1905-1906 ..	16·98	13·95	82·15	1·95	36·86
Ivory Mauritius, 1904-1905	18·67	16·11	86·29	·75	38·96
,, ,, 1905-1906	17·87	15·37	86·01	1·34	40·41

(*Agricultural Journal of India.*)

CUBA.

An Independent View.

A correspondent, who for obvious reasons desires to remain anonymous, has recently sent us some comments on the notes which have recently appeared in this Journal with regard to the state of affairs in Cuba. Below will be found the chief details of his communication:—

"As regards the United States and their Cuban policy, there is, I think, little doubt that the former regard their war with Spain as a mistake, and yet actually think they can escape the consequences. They now do not want either Cuba or the Philippines, and would like to be rid of them; this is mainly owing to the opposition of their own sugar growers and tobacco planters, these well knowing that once let Cuba be American they could not compete with her either in sugar, tobacco, or fruit. The Sugar Trusts have got Cuba by the neck, and they force the Cuban planter to accept the price they choose to give him. This is accomplished in the following way. Owing to the framing of the United States duties, Cuba cannot refine her sugar; she is obliged to produce a sugar to sell to the United States refiner, and which, owing to her climate and the above restrictions, does not and will not keep well any length of time, hence the Cuban planter is forced to sell as he makes or at latest a month or two after manufacture. The planter is not a millionaire, and generally wants money, and as there are no banks, or at any rate none which will operate on the security the planter has to give, the latter is obliged to get it from the 'Comerciante' or 'Almacinista' at the nearest large port, and this Spanish comerciante is of the same mould as the Dundee Scotsman, of whom it is said no Jew would have any chance with him. The Trust has the comerciante all over as his agent, hence it suits the comerciante that the sugar should all be sold to the Trust, and he is opposed to selling in London—also, the lower the price of sugar the greater the facility for the comerciante to speculate since he has to employ less capital for the same gain. Why should not Cuban sugars be sold to London? I feel sure the London operators might bring about arrangements to this end with Cuban planters. The United States, if they were logical, should annex Cuba, who can never govern herself, for she is composed of a mixture of whites, negroes, and China men and their derivatives, none of whom wish to work, and all of whom wish to live on the work of others. With annexation Cuba would refine her own sugar and export to the world at large.

"Referring to these schemes of mammoth centrals with such tremendous capital, &c. Do the people realize what must be the inevitable end of all such enterprises? I am sure no Havana bank will take up anything, much less $2,750,000 of bonds! This is all balderdash!

"2000 sacks a day! After all, there are already estates as big as this, but do they know what land must be under cultivation for this amount? Do they know the cost of railways and locomotives for such an undertaking? Do they know what a 'Cuban colonist' is like? If not, they will have to pay, and dearly so, for their experience. I have heard complacent American employees of these mammoth concerns saying their cane cost them 4% in sugar * when by their dealings with the 'Cuban colonist' or the Canary Islander (who is worse) their cane was probably costing them 7%.

"It is not only American capital which is 'watered' here—British capital is also 'watered,' and did the shareholders only know it they would shudder at the mismanagement of their railroads. If the roads gain money it is not the fault of the management, for they try hard enough to prevent it!"

CONSULAR REPORTS.

PORTO RICO.

During the year 1906 two new sugar factories were completed and started work, and, while three others are in course of construction with the view of handling the coming crop, at least two others are definitely planned for operation in 1908.

Besides these additions, most of the old factories have been or are in course of being refitted with modern machinery. Modern agricultural methods are in course of adoption generally, by means of which it is to be expected that the Porto Rican sugar yield can be brought to equal that of Hawaii, which is due in the greater part to scientific culture and generous use of appropriate fertilizers.

The value of sugar and molasses exported from Porto Rico during the fiscal year ended June 30th amounted to £2,983,583, showing an advance of £503,755 upon the previous year.

With the exception of a very small proportion the whole was shipped to the United States.

Mayaguez.—The British Vice-Consul reports as follows:—

The exports of sugar during the year amounted to about 8,590 tons, all centrifugal, and exclusively shipped to the United States. The crop exceeded that of 1905 by nearly 3,700 tons.

The average price of sugar for the year was 3 dol. 50 c. for 96° centrifugal. Muscovado sugar, produced, on a very small scale only, was sold locally for domestic use at high prices, ranging from 3 dol. to 3 dol. 75 c.

Exports of molasses reached about 331,560 gallons muscovado and 223,300 gallons centrifugal, of which about £3,600 worth went to British North America.

* On weight of cane.

Prices ruled from 8 to 16 dol. per 110 gallons muscovado and about 4½ c. per gallon centrifugal molasses, all first cost and according to quality.

Humacao.—The decrease in general exports during 1906 is owing to the great development of the sugar industry which from trebling the value of the land, makes it unprofitable to raise cattle for the West Indian markets.

All available lands are in use for sugar cane, in preference to anything else. The district produced 26,500 tons of sugar during the year, valued at £365,216, and there is every prospect of these figures being much increased in the future.

Ponce.—The British Vice-Consul reports as follows:—

The year 1906 has been a very fair one for this district.

The sugar crop was larger than last year's. Total exports were 400,771 bags and 301 hogsheads, equal to 57,196 tons, against 42,688 tons in 1905, or an increase of 14,508 tons. Yet, owing to lower prices, the value was only £793,199, against £790,380 in 1905.

There are now five central factories working in this district.

The largest one, Guanica Centrale, paid a dividend of 8 per cent. on £300,000 preferred shares. This large plant will increase its daily capacity, which is of 2,400 tons cane, to 3,000 tons of cane for next year's crop.

The French company, Compagnie des Sucreries de Porto Rico, have increased their capital from £160,000 to £400,000, and are increasing their plant from 600 tons of cane daily capacity to 1,200 tons.

No statements have been published by the other centrals on their net earnings.

Lands suitable for sugar cane continue to advance in price, owing to competition between the large central factories, and some local plantations have been leased by them for periods of 15 years, as follows:—

	Amount per annum. £
One of about 300 acres cane land at	2,000
,, ,, 500 ,, ,, ...	3,000
,, ,, 500 ,, ,, ...	3,600

Muscovado molasses continue to decrease and vacuum pan molasses (or black strop molasses) to increase. Exports were:—

		Quantity.	Value. £.
Muscovado molasses..	Hogsheads..	3,299	27,767
	,, ..	1,370	
	Tcs.	314	
	Gallons ..	662,599	
Vacuum pan (black strop) molasses in tank steamers	,, ..	1,874,600 ..	12,000
Total, 1906			39,767
,, 1905..			31,501

The 1,874,600 gallons vacuum pan molasses shipped by tank steamers were all sold and shipped to the United Kingdom, the destination being London and Liverpool.

Local distilleries made from vacuum pan molasses about 350,000 gallons of rum, all for island consumption. The price for rum is 1s. 3d. per gallon of 40° Cartier, to which must be added 4s. 1d. per gallon internal revenue.

Réunion.

The British Consul reports:—

The amount of sugar, the staple product of this island, exported in the last four years has been as follows:—

Year.	Quantity. Metric tons.
1903	19,336
1904	11,314
1905	8,595
1906	15,508

The total amount of sugar manufactured in 1906 amounted to 38,000 metric tons. The year was a very good one as regards quantity and quality, but a very bad one as regards the prices obtained. The principal sugar growing and refining establishment in Réunion is that of the Crédit Foncier Colonial, which owns some of the best estates in the island. This company and the owners of a few of the largest estates, who could afford to send their sugar to France and wait for a slight rise before selling, have probably incurred no loss on the year, but the smaller planters, who are compelled to sell locally in local currency, have undoubtedly worked their estates at a loss. The average difference between the cost of production and the market price was from 10 to 15 per cent. against the planters. The price of sugar at the time of writing this report is 22 fr., and I see no immediate prospect of a rise. Up to now but three-fifths of the 1906 crop have been sold. The great fall in the rate of exchange has also hit the planters very hard.

During the last 18 months some 9,000 metric tons of Réunion sugar were bought by the local Indian merchants for sale in Bombay, and fetched an average price of about 17s. per 100 kilos. (220 lbs. avoir.). At one time it was thought that a profitable market for Réunion sugar had been found, but, owing to the fall in price, no further cargoes have been sent up to now. The sugar sent to Bombay was principally in part payment of Indian and Burmese rice which had been bought by these merchants. Several sugar mills have shut down during the year, and the first step has at last been taken towards the creation of central sugar mills and refineries, a matter of vital importance to the colony's prosperity. In fact many planters hold that this is the only manner in which sugar can still be manufactured in this colony so as to leave a fair margin of profit.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Applications.

10196. J. W. MacFarlane, Glasgow. *Improvements in apparatus for the treatment of sugar in the centrifugal drying machine.* 2nd May, 1907.

ABRIDGMENTS.

9416. L. Fokányi, Budapest, Hungary, Baron R. Tornyay-Schosberger de Tornyay, Budapest, Hungary, and Dr. S. Weiser, Budapest, Hungary. *Process for drying molasses and molasses food-stuffs.* 21st April, 1906. This invention relates to a process for manufacturing molasses-food-stuff mixtures, characterised by the fact that calcium hydroxide or calcium oxide, or a mixture of both, is added to the said molasses or food-stuff mixtures, for the purpose of fixing the contained water, and after the fixing has taken place, subjecting the same to the action of carbonic acid preferably under pressure.

28767. P. Bevenot, Paris, France. *An improved process and apparatus for the extraction and desiccation of the solid parts contained in natural fluids or in solutions, and particularly for the production of milk powder, and the extraction of sugar from saccharine juices.* 17th December, 1906. This invention relates to a process for the desiccation of the solid matters contained in natural fluids or in solutions, particularly for the production of milk powder, and the extraction of sugar from saccharine juices, in which the fluid or juice to be treated is compressed and projected through an atomizer into a desiccating chamber through which currents of hot air are caused to rise, the directing of the atomized fluid or juice into the desiccating chamber in a slightly downward direction, and the introduction of the jets of hot air into such chamber at two different levels, whereby the atomized particles are progressively desiccated, the upper jets of hot air removing the greater part of the moisture, and the lower jets completing the desiccation.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of April, 1906 and 1907.

IMPORTS.

Raw Sugars.	Quantities. 1906. Cwts.	Quantities. 1907. Cwts.	Values. 1906. £	Values. 1907. £
Germany	3,213,249	2,970,518	1,356,201	1,353,579
Holland	38,036	57,881	14,341	24,259
Belgium	194,838	148,589	79,013	64,261
France	153,708	92,434	65,420	44,428
Austria-Hungary	108,932	244,946	45,225	110,787
Java	87,997	64,058	41,466	33,230
Philippine Islands	....	20,000	....	8,500
Cuba	111,910	96,000	41,943	39,600
Peru	301,431	124,008	137,359	57,874
Brazil	734,089	182,369	288,570	75,239
Argentine Republic	....	....	....	....
Mauritius	30,769	148,391	12,068	62,678
British East Indies	....	....	....	....
Straits Settlements	29,060	58,198	12,412	25,057
Br. W. Indies, Guiana, &c.	583,498	555,028	346,229	325,585
Other Countries	57,004	341,605	26,261	169,303
Total Raw Sugars	5,644,521	5,104,025	2,466,508	2,394,380
Refined Sugars.				
Germany	3,568,423	3,834,594	2,030,339	2,229,776
Holland	900,949	941,436	534,841	583,788
Belgium	106,371	87,580	62,034	53,041
France	671,919	853,399	374,426	485,843
Other Countries	343	457	220	349
Total Refined Sugars	5,248,005	5,717,466	3,001,860	3,352,797
Molasses	834,155	852,614	166,917	166,211
Total Imports	11,726,681	11,674,105	5,635,285	5,913,388

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	127	178	114	116
Norway	5,877	5,198	3,574	3,069
Denmark	33,458	33,572	17,005	17,336
Holland	25,792	24,541	15,124	16,091
Belgium	3,314	3,054	1,706	1,810
Portugal, Azores, &c.	13,592	11,910	7,330	6,467
Italy	13,413	8,015	7,013	4,181
Other Countries	205,254	108,762	131,314	79,977
	300,827	195,230	183,180	129,047
Foreign & Colonial Sugars				
Refined and Candy	8,167	4,298	5,310	3,202
Unrefined	86,176	20,740	45,355	11,640
Molasses	4,771	1,525	1,498	417
Total Exports	399,941	221,793	235,343	144,306

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to May 16th ..	883,753	..	799,667
Receipts of Refined ,, ,, ...	405	..	975
Deliveries ,, ,, ...	842,306	..	817,006
Consumption (4 Ports, Exports deducted) since January 1st..	653,710	..	636,780
Importers' Stocks, May 15th..	41,447	..	41,193
Total Stocks, May 22nd	380,000	..	365,800
Stocks in Cuba, ,, ...	408,000	..	327,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1906 AND 1907.

(Tons of 2,240lbs.)	1906. Tons.		1907. Tons.
Exports	559,797	..	753,057
Stocks	328,130	..	462,480
	887,927	..	1,215,537
Local Consumption (four months)	15,540	..	16,250
	903,467	..	1,231,787
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 30th April	884,017	..	1,231,787

Havana, April 30th, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR FOUR MONTHS ENDING APRIL 30TH.

SUGAR.	IMPORTS. 1905. Tons.	1906. Tons.	1907. Tons.	EXPORTS (Foreign). 1905. Tons.	1906. Tons.	1907. Tons.
Refined	203,405	262,400	285,873	280	408	215
Raw	207,407	282,226	255,201	721	4,309	1,037
Molasses	38,024	41,708	42,631	20	238	76
Total..........	448,836	586,334	583,705	1,021	4,955	1,328

	HOME CONSUMPTION. 1905. Tons.	1906. Tons.	1907. Tons.
Refined..	195,190	244,935	268,436
Refined (in Bond) in the United Kingdom	158,213	178,962	162,773
Raw	29,278	36,670	29,456
Molasses	37,827	40,895	38,681
Molasses, manufactured (in Bond) in U.K.	17,717	23,103	24,812
Total	438,225	524,565	524,158
Less Exports of British Refined.....................	6,516	15,041	9,761
Total Home Consumption of Sugar	431,709	509,524	514,397

Stocks of Sugar in Europe at uneven dates, May 1st to 18th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1907.
176	946	601	557	171	2452

	1906.	1905.	1904.	1903.
Totals	2809 ..	1993 ..	2543 ..	2505

Twelve Months' Consumption of Sugar in Europe for Three Years, ending April 30th, in thousands of tons.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1851	1149	644	554	206	4404	4003	4018

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1906-1907.	1905-1906.	1904-1905.	1903-1904.
	Tons.	Tons.	Tons.	Tons.
Germany	2,250,000 ..	2,415,136 ..	1,598,164 ..	1,927,681
Austria	1,335,000 ..	1,509,870 ..	889,373 ..	1,167,959
France	755,000 ..	1,089,684 ..	622,422 ..	804,308
Russia	1,450,000 ..	968,000 ..	953,626 ..	1,206,907
Belgium	280,000 ..	328,770 ..	176,466 ..	209,811
Holland	190,000 ..	207,189 ..	136,551 ..	123,551
Other Countries .	440,000 ..	415,000 ..	332,098 ..	441,116
	6,700,000	6,933,649	4,708,758	5,881,333

THE

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The Editor will be glad to consider any MSS. sent to him for insertion in this Journal and will endeavour to return the same if unsuitable; but he cannot undertake to be responsible for them unless a stamped addressed envelope is included.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTICE TO READERS.—If the Advertisement pages stick together, bang their edges on the table, when they should easily separate.

NOTES AND COMMENTS.

The Fate of the Convention.

The period of comparative quiet which has existed in the sugar world for some time past was abruptly terminated early last month, when on the eve of the meeting of the Brussels Permanent Commission Sir Edward Grey made a statement in the House of Commons to the effect that his Government had come to the conclusion that the provisions of the Convention were inconsistent with their declared policy of free trade, and that therefore it would be impossible for them to continue to give effect to those provisions which required them to penalize all sugars that the Commission declared to be bounty-fed. So it comes to pass that the one real free-trade measure which the late Government brought into existence is threatened with extinction, simply to satisfy the demands of a noisy section of the Government party in the House who make themselves the mouthpiece of one isolated portion of the community; and the West Indies are once more to have their prospects jeopardized by a renewal of that feeling of insecurity which in former days went so far to retard every scheme for improvement. We do not think that the Cabinet as a whole are enthusiastic at the step they propose to take; we fancy

that Sir Edward Grey found his task a distasteful one. But the claims of the party Fetish were supreme, so the die had to be cast and now one of the justest and most impartial international agreements ever concluded by the European Powers is in danger of extinction.

Elsewhere will be found some details of the reception accorded to this announcement by the press both at home and abroad. The foreign press opinions are, however, for the time being of chief importance. The German view which we reproduce at some length probably expresses the general opinion on the Continent. England, we are told, wants to enjoy the benefits of the Convention while at the same time being at liberty to shirk her share of the responsibility. She wants to be secure from the *disadvantages* of bounties, but at the same time to be free to accept the alleged *advantages*. Her Government calmly ignores the fact that she is the greatest market the sugar world possesses, and makes the amazing suggestion that the United Kingdom should be classed with such comparatively obscure sugar countries as Switzerland, Sweden, and Spain in the enjoyment of special benefits, which were probably only accorded the latter because the influence of their sugar production and consumption was inappreciable. As far as the ethics of the question are concerned, the foreign organs are certainly justified in demanding that their Governments shall unhesitatingly refuse to entertain England's proposal. And the general irritation which has been caused abroad by her arbitrary suggestion will certainly not make it easier for the parties to come to terms. It seems most probable that in the event of England withdrawing as she threatens to do, the other Powers will endeavour to carry on the Convention among themselves. But England being out of it, she will no longer obtain any consideration; and she is already being warned in no uncertain tones that the inevitable result of her once more using bounty-fed sugar will be the levying of a countervailing duty on all goods made with such sugar, on their entry into any of the Convention-States. In a few words, the British Confectioners who are at the bottom of all this trouble are to be "hoist with their own petard." They cannot say they have not been warned. We have ourselves more than once referred to the possibility of this form of retaliation, and other papers, for example, the *British Trade Journal*, which cannot be considered over-friendly to the Convention, foresaw the same danger. Is it now too late for the Government to realize that they are preparing to forge a weapon to be used against that very industry which they profess to be so solicitous to support? We shall see, when the opportunity comes for a debate in the House of Commons, whether the above-mentioned threat has made any eleventh-hour impression on the Government; or whether they are determined to push on blindly with their proposal whatever be the ultimate outcome. If the latter be the case,

then we are certain it will only prove a heavy blow to their reputation, though by no means the first one which, within the short period they have been in office, they have unquestionably brought upon themselves.

And After.

If the British demands are adhered to and denunciation follows, the Powers may, as we said, resolve to carry on the Convention without England's co-operation. But will this after all be the best plan for them? They are aware that opinion in this country is rapidly veering round in favour of Tariff Reform. If England is free from the obligations of the Convention when the Reform party get into power, then the latter will be at liberty to treat foreign sugar as they please. On the other hand, if the Convention is still in existence and England a party to it, the sugar trade will not be subjected to any startling changes. As the *West India Committee's Circular*—which is mainly concerned with the immediate outcome for the West Indies—goes to the length of suggesting, the foreign Powers might well give consideration to the fact that the present decision of the British Government is purely a party one, and does not represent the view of the whole country. As the Liberal Government may not be in power a few years hence, but may have given place to the party which helped to produce the Convention, would it not be better to agree to the proposals of Great Britain and accept them as a temporary measure?

The chief merit of this proposal seems to be that it would for the present save the world's sugar trade from the risk of dislocation which any new *status quo* would be sure to bring about. It must not be forgotten that the Convention has yet another year to run, and that, subsequently, it need not be renewed for more than twelve months at a time. If our Government will not renew for even that short period, the foreign States might yet see their way to doing so, even under the modified conditions, in the hope that a better chance would eventually occur of renewing under the old terms. But is this solution the one which the present Government hope to encompass? Are they anxious to shelve the question while seemingly responding to the demands of their supporters? If so, it will be interesting to see which party will agree to pick the chestnuts out of the fire. Before this month is out, the several Governments will have instructed their representatives at Brussels, and we shall learn what decision has been arrived at. England will then have another month wherein to make up her mind what step to take on September 1st.

Chambers of Commerce and the Sugar Convention.

As we mentioned in our last issue, various Chambers of Commerce all over the Empire have been expressing decided opinions in favour of the retention of the Brussels Convention. We however omitted to

give credit to the West India Committee who, it appears, as far back as February last circularized the leading Chambers of Commerce of the Empire on this question. The replies from the Chambers have been almost entirely favourable to the Convention, though one or two, for example, Bombay, have adopted a neutral attitude, contenting themselves with an expression of sympathy for the West Indies. But those who are in favour of a continuation of the Convention include Cawnpore, Karachi, Madras, Halifax, Hamilton, Montreal, Vancouver, Victoria, Geelong, Orange River, Pietermaritzburg, Sierra Leone, and Singapore. The attitude of the Indian Chambers is, as the *Times* points out, a noteworthy one, having regard to suggestions recently put forward in a pamphlet of the Cobden Club that "the Sugar Convention has not benefitted the West Indies effectually, but has made India suffer substantially" owing to alleged retaliatory enhancements of Russian import duties on Indian tea. It must be observed too that the action of the Karachi Chamber is largely dictated by the fact that, in their opinion, the Indian countervailing duties necessitated by the European bounties were *a distinct disadvantage to free working in India.* In other words, the Convention tended towards *free trade;* but this conclusion is one which the Free Traders at home have always refused to admit.

Beet Sugar Prospects in the United Kingdom.

In spite of the uncertain situation engendered by the attitude of the British Government towards the Brussels Convention, it seemed evident till the other day that the schemes for starting beet sugar factories in this country were progressing towards completion. At Sleaford, Lincolnshire, contracts were being entered into with the surrounding farmers for the growing of beets for five years at least, and nearly a thousand acres had been reserved for the purpose, to be used when the Dorrington factory came into existence. Another scheme involved the erection of a factory on the Ouse, near York, where carriage facilities would be exceptionally good. The promoters of these schemes seemed to count somehow on a rebate of the sugar duty being granted to home grown sugar, such as is the case in other Convention countries. But if they thought the present Government was likely to grant this preference, they know better now. In fact, the whole situation has been changed by the revelation of the Government's intentions towards the Brussels Convention. It was announced last week that the Sleaford scheme was in consequence to be entirely abandoned. This is only another illustration of the remarkable way in which this Free Trade Government, while professing such concern in the land question, nevertheless simultaneously takes steps to put it out of the power of the tillers of that land to embark on any new and profitable venture. Sir Edward Grey in his Despatch to the British Minister at Brussels stated that the Government had no intention of

giving rebates or preferences to home grown sugar; and when to this is added the fear that the Convention itself may fall through, it seems inevitable that all schemes for producing home grown sugar should have to be shelved *sine die.*

The Convention and British Trade.

A writer in the *Birmingham Daily Post*, in discussing the results of the Brussels Convention on British trade, gives the following interesting information:—

"No one country, however, can afford an adequate idea of the stimulus that has been given to production all over the world. The total yield last year was estimated at nearly twelve million tons, an increase of 1,500,000 in the three years the Convention was in operation, and far in excess of the previous natural growth of consumption. But whereas formerly the production of beet was steadily on the increase while that of cane just as steadily declined, now the gain is equally distributed. How much this means to British industry is easily established. To begin with, the machinery for beet extraction and manufacture is nearly all made in the producing countries, while for cane the orders have to be placed in this country or the United States, and for the past three years our sugar machinists have been exceptionally busy and turned out work to the value of between £1,000,000 and £2,000,000. Nor does the advantage end there, because cane-producing countries are tropical or semi-tropical, and not as a rule given to manufacturing enterprise, so that whereas France and Germany and Austria expend the proceeds of their sales to this country mostly in purchasing raw material for their numerous industries, Java, Brazil, Peru, and similar cane-growing countries buy British manufactures and merchandise with the money they obtain with their sugar."

Labour for Queensland.

In pursuance of the policy initiated by the Queensland authorities to obtain white labour for their cane fields, recruiting has been taking place among the unemployed in London, and a first contingent of British labourers, amounting to 150, left England for Australia about a month ago. The wages will vary from 32s. 6d. to 45s. per week, according to the class of work they undertake. We gather that the term of the contract will last till December 31, 1908. It is to be noted that Queensland is not the only cane country which suffers from a scarcity of labour. Louisiana's plight is old history by now, and even the Hawaiian Islands are getting into difficulties. Both these districts are endeavouring to obtain labourers from Malaga, Spain.

Cuba.

In our notes on Cuba last month the figures of the crop were by inadvertence wrongly given. The total crop was not expected to exceed 1,300,000 tons; but according to Guma's figures the actual amount to May 31st has been 1,363,664 tons, a slight increase on earlier estimates. The drought has at length broken, and spring planting is being pushed forward everywhere; but it is late for the next crop and will have to be used either as seed for the fall, or be left over till the next year; consequently, there seems little doubt that the coming crop will be very much below this year's total. One forecast puts it at no more than 750,000 tons. Cane fires have been raging all over the island, destroying the ratoons in many cases, and as the latter do not recover from conflagrations unless rain comes directly afterwards (which has not been the case this time) hundreds of acres have been wiped out.

THE GOVERNMENT AND THE BRUSSELS CONVENTION.

The confectioners, who have assumed the role of expert advisers to the Government on the sugar question, have done their best to misrepresent every fact—even to the substitution of fiction for fact—and to deceive their willing pupils in every possible way. When their statements are particularly wild and romantic we actually find members of the Government quoting them as reliable evidence. They have succeeded in making Ministers believe that the Convention, by shutting out Russian sugar, has deprived the country of its supply of sugar.

Our continental friends, who understand every detail of the sugar question, are naturally astonished at the ignorance displayed in this country, and can hardly believe it possible that the British Government should denounce the Convention on such ridiculous grounds as those suggested by them at the instigation of the confectioners.

An interesting article on the subject, by M. Georges Dureau, the Editor, appeared in last week's *Journal des Fabricants de Sucre*, 26th June, 1907, based on a careful study of the question by Dr. Albert Bartens in *Die Deutsche Zuckerindustrie*, Nos. 2, 3, 4, 5, 6, 9, of 1907.

He begins by asking, "has England been short of sugar under the *régime* of the Brussels Convention?" Statistics say "No." The quantity of sugar imported has increased distinctly since the application of the Convention. The apparent consumption per head (about which we shall have something to say another time) has, it is true, fallen off; but the price of sugar has not increased, except for a time, in 1905, when exceptional weather caused a large deficit in the beetroot crop. From 1893 to 1902 the average price of raw sugar imported

into England was 10s. 3d. per cwt., and that of refined sugar 13s. 4d. But in 1906 the raw sugar only cost 8s. 9d., and the refined 11s. 7d. There is therefore no question of prices having been raised by the Convention. If the consumption per head has fallen off, it has been owing to the sugar duty not the sugar Convention. In 1906 the importation of sugar into this country amounted to 1,667,800 tons, a figure never before attained. During the last 14 years the importation of refined attained its maximum in 1901; in that year the proportion of refined was 61 per cent. and that of raw 39 per cent. of the total. At that time the system of bounties and cartels was flourishing. Since their abolition the importation of refined sugar has decreased; in 1905 it fell to 50 per cent. of the total imports, increasing, it is true, to 54 per cent. in 1906.

It was in 1900 that the importation of raw beetroot sugar attained its maximum; its proportion in that year was 81 per cent. of the total importation of raw sugar, cane sugar being only 19 per cent. Since the abolition of bounties and cartels these proportions show signs of being reversed; that of beetroot fell to 57 per cent. and that of cane sugar rose to 43 per cent. The increase of British West Indian sugar was only slight because it was attracted to Canada by the preferential treatment in that country.

We have lost our supplies from Argentina, which amounted, in 1901, to 33,317 tons, in 1902 to 40,447 tons, in 1903 to 20,919 tons; a perfectly negligible quantity out of the ten million tons from which we can choose.

Our supply of raw beetroot sugar, though it declined in 1905 owing to the short crop, increased in 1906, thanks to the abundant European production, to 554,433 tons, representing 73 per cent. of the total imports of raw sugar. As to Russia and our loss of the supply from that quarter, M. Dureau gives the following figures, but we must add that they do not represent the total quantity of Russian sugar imported, because some came via Germany. Going back to 1896, M. Dureau points out that at that time we imported 12,356 tons of Russian raw sugar and 30,036 tons of refined. Again, we ask, what is this compared with the world's production of 10,000,000 tons which is free to come to us? Since then the quantity has declined. In 1903 we imported 1,162 tons of raw sugar and 4,002 of refined. There could not be a stronger proof than that given by these figures. Russia, if she had had a large surplus stock to dispose of, would have poured the sugar into this country before the door was closed; as she did not do so, she clearly had no available supply. All who have any intimate knowledge of the sugar markets and supplies of the world know perfectly well that this was so. From that time to a year ago Russia had no surplus that required any outlet beyond the customary exports to Finland, Persia and the East.

So much for Lord Denman's declaration in the *Times* a few days ago, that the high prices of 1905,—really and solely caused by the reduction of the beetroot crop and the consequent speculations for May and August—were caused by our loss of the supplies from Russia and the Argentine.

We evidently had no lack of sugar; we exported more refined sugar in the four years 1903-6 than we did in the preceding four years 1899-1902. Moreover, as Mr. Lloyd-George told us the other day, the confectioners exported, in the years 1904-6, an average of 362,004 cwts. per annum, while in the three years preceding the Convention, 1901-3, the average yearly exports were only 320,917 cwts.

M. Dureau winds up this interesting statement as follows:—

"To sum up, according to these statistics the sources of sugar open to England under the *régime* of the Convention remained numerous, varied, abundant; and the price of sugar—except during the deficient crop of 1904-5—has not increased. The economic situation of the sugar market of England has been well examined, and we discover no fact which militates in any serious manner in favour of the grave determination which the Government of that country has taken."

THE SUGAR CONVENTION.

Threatened Denunciation.

On the 6th of June, Sir Edward Grey, in replying to a question in the House of Commons, at last made a definite pronouncement with regard to the Government's intentions towards the Brussels Convention. He said (to quote the *Times* report):—

"The Permanent Commission under the Sugar Convention will meet to-day. His Majesty's Government have intimated to the contracting States, through the Belgian Government, that they consider that the limitation of the sources from which sugar may enter the United Kingdom, whether by prohibition or by the imposition of countervailing duties, is inconsistent with their declared policy and incompatible with the interests of British consumers and sugar using manufacturers—(cheers)—and that consequently it will be impossible for them to continue to give effect to the provisions of the Convention requiring them to penalize sugars declared by the Permanent Commission to be bounty-fed. (Cheers.) At the same time we have pointed out that we have no desire to give sugar bounties or to see a revival of such bounties, or to differentiate against beet or foreign sugars. Should the Governments of the contracting States consider that our views can only be met by the complete withdrawal of this country from the Convention, we would be prepared to give the necessary notice on the first possible date. (Cheers.) We have, however, intimated that if the other contracting

States prefer to exempt the United Kingdom by supplementary protocol from the obligation to enforce the penal provisions of the Convention, this would render it unnecessary for us to give notice of withdrawal."

On Lord Balcarres asking when the despatch would be laid on the table of the House of Commons, Sir Edward Grey said he could not say, but it would be convenient if it was done when some conclusion had been arrived at.

But though the Government refused at the time to publish their despatch to their Minister at Brussels, the Foreign Offices of France, Belgium, and Germany evidently supplied the press with translations, for the chief Continental sugar papers reproduced it in full. This fact seems to have been brought to Sir Edward Grey's notice, for on the eve of our going to press the despatch was published as a Parliamentary paper. It ran as follows:—*

Foreign Office,
June 1st, 1907.

Sir,

His Majesty's Government have had under consideration the question of the steps which it will be necessary for them to take with regard to the participation of this country in the Sugar Convention when the date arrives on which it will be possible for any of the contracting States to give a year's notice to retire from the Convention under the provisions of Article X. of that Instrument. In considering this matter they have naturally felt themselves bound to give the greatest weight to the interests of consumers and producers in the United Kingdom and the British Colonies; but, subject to this paramount consideration, they have desired to give proper weight to the circumstances and possible wishes of the other contracting States.

His Majesty's Government have come to the definite conclusion that the limitation of the sources from which sugar may enter the United Kingdom, whether by prohibition or by the imposition of countervailing duties, is inconsistent with their declared policy, and incompatible with the interests of British consumers and sugar-using manufacturers, and that consequently it will be impossible for them to continue to give effect to the provisions of the Convention requiring them to penalize sugars declared by the Permanent Commission to be bounty-fed.

At the same time, His Majesty's Government have no desire that there should be a revival of sugar bounties or of sugar trusts or Cartels dependent on the existence of high protective tariffs, which are now prohibited under the Convention. Nor is there any desire or intention on their own part that any bounties on

* A translation of the French version of this despatch had been prepared by us for this number, but owing to the Government finally acquiescing in the publication of the original, we are enabled to substitute the latter for our rough translation.

the production or exportation of sugar shall be given in the United Kingdom, or in the sugar-exporting Crown Colonies, or that any preference shall be given to cane as against beet sugar, or to Colonial sugar as against the sugars of the contracting States on importation into the United Kingdom or the Crown Colonies.

The President of the Permanent Sugar Commission at Brussels having very courteously tendered to the British delegates the good offices of the Belgian Government in regard to any discussions which might take place concerning the termination or prolongation of the Convention, I have thought it desirable to request you, without loss of time, to bring the foregoing considerations to the notice of the Belgian Government, with a view to their communication to the Governments of the contracting States.

Should these Governments come to the conclusion that the wishes and intentions of His Majesty's Government, as indicated above, can only be realized by the complete withdrawal of this country from the Convention, His Majesty's Government will be prepared to give the necessary notice on the first possible date.

It is, however, possible that, in the special circumstances of the case, the other contracting States might judge it to be preferable to accord to the United Kingdom, by a supplementary protocol, a special exemption from the obligation to enforce the penal provisions of the Convention. They might be the more disposed to take this course, inasmuch as such an exemption would be unlikely, at all events for a considerable period, to have any material effect of a prejudicial character upon the export trade in sugar from any of the contracting States. You should point out that it has already been found that the special circumstances of a particular contracting State make it desirable that it should be exempted from certain stipulations of the Convention. Thus, to Italy, Sweden, and Switzerland there have been accorded special exemptions from the stipulations of the Convention that were not appropriate to the conditions of the trade of those countries.

In the event of the contracting States agreeing to take the course indicated above, His Majesty's Government would be prepared to abstain for the present from giving the notice of withdrawal which they would otherwise feel it their duty to give on the 1st of September next.

Should the Belgian Government be willing to exert their good offices in this behalf, I have to point out that in view of the meeting of the Commission fixed to take place on the 6th inst., it would be desirable that communications should be addressed to the contracting States as soon as possible.

I am, &c.,

(Signed) E. GREY.

The Brussels Permanent Commission only sat for two days. The British Delegate informed them that his Government could not remain a party to the International Union under the conditions prescribed by the Convention, as they found the provision imposing countervailing duties on bounty-fed sugar too onerous. The Commission, not being competent to consider the admissibility of the British proposal, adjourned for a month, so as to allow the representatives to consult their respective Governments.

Although not altogether unexpected, Sir Edward Grey's declarations have aroused considerable attention at home and abroad. The German view will be gleaned from a perusal of the chief portions of a leading article in the *Deutsche Zuckerindustrie*, of which a translation appears below. Much the same view is held by Licht, of Magdeburg, in his Monthly Report, and he concludes that in the event of England once more admitting bountied sugar within her markets, the other European parties to the Convention are bound to impose a countervailing duty on all imports of British confectionery made with such bountied sugar. The French opinion is hostile to any alteration in the nature of England's participation in the Convention. Austria, which looks on Great Britain and India as her best customers, is likewise indisposed to acquiesce in the British proposals; but the hope is expressed that notwithstanding England's withdrawal, the Convention may be continued by the remaining States.

At home the proposal of the Government has met with unanimous condemnation on the part of the Unionist press, while, if we except the views of the confectioners for whose special benefit this retrograde step is being taken, expressions of opinion amongst those who were expected to welcome the change have been in many cases singularly mild. Many of these erstwhile opponents of the Convention are not altogether convinced that the withdrawal of England will have any appreciable effect on the price of sugar for consumption, so that the "cheap sugar" cry has been somewhat less conspicuous than might have been supposed.

The *Times*, in discussing the matter in a leading article, summed up the case very aptly when it declared that "it fell to Sir Edward Grey's lot to give perhaps the most remarkable illustration of fiscal policy of the Government that has yet been afforded. The Goverment have intimated to the other States who are contracting parties to the Sugar Convention that they can no longer carry out the provisions penalizing bounty-fed sugar, on the ground that it is 'inconsistent with their declared policy and incompatible with the 'interest of British consumers and sugar-using manufacturers' to place any limitation on the sources of supply. We debar ourselves, in other words, from taking any action to enforce the objects of the Convention. But if the other countries are content with our purely platonic assent to the Convention, then we shall be glad enough to stay. . . . .

The Government do, in a tepid kind of way, disapprove of bounties. They would not have the faintest right to the title of a free-trade Government if they did not. But their disapproval does not extend to taking any practical step to cope with the situation. In fact, it is an attitude of complete paralysis all round. . . . . The Government have quite spoiled the case for principle by mentioning the interests of consumers and sugar-using manufacturers. Is it these interests, or fiscal orthodoxy, that is the governing consideration? If fiscal consistency is the true plea, why should anything so squalid as the interests of mere consumers or producers be taken into account at all? If the interests mentioned are the real thing, why should these interests be selected in preference to all others? The sugar-using manufacturers, when all possible importance has been given to their industries, are not the only producers concerned. We have not been so careful, for example, of the interests of the sugar refiners. Nor, since by an act of partly vicarious virtue we emancipated the slaves, have we been particularly mindful of the interests of the West Indies, whose cane sugar industry enjoyed a deserved revival under the Convention."

The *Times*, after referring to Mr. Gladstone's dictum that no "benefit founded on inequality and injustice can bring good even to the consumer," went on to show that the justification for the Convention lay in the fact that it gave us greater security of supply. But this security the Government were now prepared to jeopardize on a most short-sighted view of the interests of the consumer. In short, the West Indies were now to be offered up on the same altar as were the colonies at the late conference "in obedience to what can only be called a piece of fiscal prudery."

The *Deutsche Zuckerindustrie*, in its issue of June 14th, discusses at considerable length the situation produced by this action of the British Government. Below will be found a free translation of the chief portions of our contemporary's leading article:—

"The British Government in its Note to the Permanent Commission, just made public, is not able to adduce a single fact to show that any material damage to British interests has accrued from the Convention. It therefore confines itself to a general recapitulation of the charges which over and over again have been unconvincingly levelled against this measure in deference to the Party Programme, viz., the injury inflicted on the sugar consumers and the ruining of certain industries using sugar as a raw material. Hereupon the British Government involves itself in an inextricable paradox. It declares itself opposed to the resuscitation of sugar bounties or the revival of Kartells and Trusts. Nevertheless, it complains that through the Convention that country is cut off from certain sources of supply, which supply comprises all bountied sugars. How can a Government which

declares itself opposed to State and private bounties venture to complain that the entry of bountied sugars into its country is debarred by the terms of the measure?

"Let us now see what the effect of all this will be.

"*The British proposal is totally unacceptable to the remaining Powers.* If it were accepted it would mean that the other parties to the Convention would be deprived of their most valuable right, the guarantee that they should obtain admission to their most important market under conditions of equality and fair trade. The Convention obliged the contracting States to suppress all direct and indirect bounties; it moreover required them to revise their systems of taxation so that the industries concerned might have enough elbow-room within which to efficaciously protect themselves. When England therefore undertook either to prohibit the entry of bountied sugars or else to saddle them with a countervailing duty, her promise was obviously no more than the inevitable *quid pro quo* for the sacrifices imposed upon the industries of the producing countries. Therefore to agree to the new proposals of the British Government, would mean to deliver up the industry of the remaining States with tied hands to their favoured competitors. The British Government founds its present proposal on the assumption of an exceptional position, and points to Italy, Sweden, and Switzerland, to which countries, as is known, the Brussels Convention has accorded certain privileges. But this reference does not go to the root of the matter, and is entirely misleading. The question involved is of an entirely different nature; and even that country, which as a purely consuming State most nearly equals England, to wit Switzerland, has not been relieved of the obligation to impose countervailing duties; on the contrary these have been accentuated in regard to Switzerland, inasmuch as the Swiss representative at the Brussels Convention was excluded from participating in the deliberations in regard to the fixing of countervailing duties on bountied sugar.

"However much the British Government may desire to be absolved from their obligations for the simple reason that the latter are opposed to the free trade doctrines to which they have subscribed, the remaining States must insist on their common rights, and accordingly must decline to respond to the English demand. The even balance of right and duty, such as every modern treaty demands, would be destroyed by any such concession. But what is more, other considerations of a most weighty kind will show that the English proposal is quite unacceptable. If it were agreed to, then our sugar would have to compete with bountied sugar on the English market without our sugar possessing any weapon to fight with; while on the other hand, the British sugar-using industries would have an advantage over similar industries in convention-countries, since in the production of their goods cheap bountied sugar would be used, and

these would be placed on the world's market at prices defying competition, without the other countries having any remedy against the entry of such goods within their own markets. For England would belong to the Convention as before, and would offer a strong opposition to the inevitable penalizing of her sugared goods. England's remaining a party to the Convention under their conditions would therefore be to the greatest disadvantage of the remaining Convention-States. The British proposal should therefore be declined.

"If England, on meeting with a refusal, decides to denounce the Convention, it may be asked what the effect on the latter will be. With the departure of England from the Convention—an eventuality which, to judge by Sir Edward Grey's Statement, we must be prepared for if the British proposals are rejected, as we think they ought to be—the situation is entirely altered. This Statement, as might have been gleaned from the whole history of the Brussels Convention, did not give the impression that it would be England herself who would be the first to denounce the Convention. For the latter has practically had its beginning at the instigation of England. If England ceases to be a party to the Convention, it would certainly be according to the letter if not of the spirit and purpose of the measure that the Belgian Government should decide to await denunciation from another State before summoning another Conference to assemble.

"It would have to be admitted that the German sugar industry hardly has a longing for the restoration of the bounty system. The latter has been buried once for all by the Convention, and there are no experts who would desire its renewal. Whether the aversion to bounties exists amongst the other participating States to the same extent as it does with us, is more than we can say.

"On the other hand, the Governments have the greatest interest in continuing undisturbed a state of affairs so favourable to their finances and so full of expectation. There are, therefore, two possibilities to be considered in the event of England standing out of the Convention: 1. A guarantee of individual States against the introduction of bounties. 2. Unrestricted development of home consumption. The several Governments might surely agree to continue the Convention on these bases, even without the co-operation of England. On the other hand, the sugar industry is interested in guaranteeing the possibility of being able to remain, to some extent, on equal terms with the bountied sugar on the English market. But this can only be the case if the trade facilities at home are increased."

THE WEST INDIAN SUGAR TRADE.

Board of Trade Return.

The following is taken from a Board of Trade return, just issued, relating to the West Indian sugar trade:—

(*a.*) *Production of Cane Sugar in the West India Islands and British Guiana in each of the years 1900-5, so far as this can be stated.*

Colony.	1900.	1901.	1902.
	Cwts.	Cwts.	Cwts.
Jamaica	464,000	494,000	582,000
St. Lucia *	81,000	97,000	86,000
St. Vincent *	12,000	18,000	14,000
Barbados	992,000	1,260,000	1,152,000
Grenada	—	‡	—
Leeward Islands—			
Virgin Islands *	—	1,000	‡
St. Christopher Nevis	150,000	261,000	346,000
Montserrat	11,000	11,000	* 21,000
Antigua	218,000	198,000	268,000
Dominica	8,000	7,000	3,000
Trinidad and Tobago	925,000	1,218,000	1,156,000
Total—West India Islands ..	2,861,000	3,565,000	3,628,000
British Guiana * †....	1,895,000	2,114,000	2,403,000
Total—West India Islands and British Guiana	4,756,000	5,679,000	6,031,000

Colony.	1903.	1904.	1905.
	Cwts.	Cwts.	Cwts.
Jamaica	448,000	378,000	421,000
St. Lucia *	78,000	103,000	97,000
St. Vincent *	† 5,000	† 19,000	† 7,000
Barbados	1,276,000	1,136,000	1,052,000
Grenada	—	‡	—
Leeward Islands—			
Virgin Islands *	—	‡	‡
St. Christopher Nevis	284,000	258,000	261,000
Montserrat	17,000	10,000	5,000
Antigua	226,000	213,000	171,000
Dominica	6,000	3,000	4,000
Trinidad and Tobago	956,000	1,015,000	764,000
Total—West India Islands ..	3,296,000	3,135,000	2,782,000
British Guiana * †....	2,519,000	2,134,000	2,331,000
Total—West India Islands and British Guiana	5,815,000	5,269,000	5,113,000

Note.—No sugar is produced in the Bahamas and Turks and Caicos Islands.

* Domestic exports are given, production figures not being available.
† For the twelve months ended 31st March of the year following that stated above.
‡ Less than 500 cwts.

(*b.*) *Total exports of Cane Sugar of domestic production from the above-mentioned Colonies in each year, distinguishing exports to the United Kingdom, the United States of America, and Canada.*

Total Exports to	1900.	1901.	1902.
	Cwts.	Cwts.	Cwts.
United Kingdom	855,000	845,000	1,041,000
United States of America	3,301,000	3,860,000	3,610,000
Dominion of Canada	116,000	332,000	687,000
Other destinations	43,000	32,000	63,000
Total	4,315,000	5,069,000	5,401,000

Total Exports to	1903.	1904.	1905.
	Cwts.	Cwts.	Cwts.
United Kingdom	842,000	1,162,000	1,225,000
United States of America	2,113,000	1,728,000	1,123,000
Dominion of Canada	1,886,000	2,076,000	2,246,000
Other destinations	36,000	61,000	48,000
Total	4,877,000	5,027,000	4,642,000

NOTE.—For some of the Colonies the particulars are for the twelve months ended 31st March of the year following that stated above.

(*c.*) *Changes in the Customs rates of duty imposed on Sugar in the United Kingdom and the United States of America in the same period.*

UNITED KINGDOM.

No duties were levied on sugar until the 19th April, 1901, when the following rates of duty were imposed, and have remained in force since that date:—

	Per cwt. s.	d.
On sugar of a polarization exceeding 98° ..	4	2
,, ,, not exceeding 76° ..	2	0

With intermediate rates varying from 0·8d. to 1·2d. per degree for sugar polarizing from 76° to 98°.

UNITED STATES OF AMERICA.

The general duties on sugar have been the same throughout the period, and are those imposed by the Tariff Act of July 24th, 1897, viz.:—

	Lb. Dols.	Cts.		Cwt. £	s.	d.
Sugars not above No. 16 Dutch standard in colour, tank bottoms, syrups of cane juice, melada, concentrated melada, concrete and concentrated molasses, testing by the polariscope not above 75 degrees	0	$00\frac{95}{100}$	....	0	4	$5\frac{1}{4}$
For every additional degree in addition to the foregoing rate ..	0	$00\frac{35}{1000}$	....	0	0	1·96
(Fractions of a degree in proportion.)						
Sugars above No. 16 Dutch standard in colour, and all sugar which has gone through a process of refining	0	$01\frac{95}{100}$	....	0	9	1
Maple sugar and maple syrup..........	0	04	....	0	18	8
Glucose or grape sugar	0	$01\frac{1}{2}$	....	0	7	0
Sugar candy, and all sugars which after refining have been tinctured, coloured, or in any way adulterated	0	04 and 15% *ad valorem*.	....	0	18	8 and 15% *ad valorem*.

Changes have, however, taken place during the period in the duties imposed on sugar imported from Cuba, the Philippines, and Porto Rico. These changes were as follows:—

Cuba.—Under the Reciprocity Treaty between the United States and Cuba, approved by the Act of December 17th, 1903 (in operation from December 27th, 1903), Cuban sugar became entitled to a reduction of 20 per cent. of the general rates of duty.

Philippines.—Under Section 2 of the Act of March 8th, 1902, articles the growth and product of the Philippine Archipelago coming into the United States from the Philippine Archipelago have since the date of the Act paid only 75 per cent. of the general rates of duty: and the duty levied in the United States is further reduced by any export duty payable in the Philippines on the exportation of the product. The export duty in the Philippines on sugar is at present 5 cents per 100 kilogs. (Act of March 3rd, 1905.)

Porto Rico.—From 1st May, 1900, to the 24th July, 1901, Porto Rican products imported into the United States paid 15 per cent. of the ordinary United States Tariff duties. From 25th July, 1901, Porto Rican products have been free of duty in the United States.

It is rumoured that the Old Market Place Refinery, Bristol, will shortly start work once more. About the time the Brussels Convention was signed an attempt was made to commence operations, but in about two years the place had to close its doors again. The present venture may prove more successful as it is intended that golden syrup shall form a large proportion of the output; and as there is a large demand for this commodity, prospects are more hopeful.

SUGAR PLANTING IN MAURITIUS.

We have just been informed by an old correspondent that a large meeting of the sugar planters of the Island of Mauritius was held on the 7th May last, to petition the Governor to assist them in raising a loan of no less than £600,000, to be applied to the enlargement of their factories and the improvement of their machinery and estates; but our informant has not been able to ascertain at present the precise terms proposed to be offered by the applicants in return for the accommodation asked for. The amount, we may fairly assume, would be raised in England through the Colonial Office at about 4 per cent., as it is not likely that so considerable an amount could be raised within the colony at so low a rate of interest, or indeed raised at all, more especially as the planters have come forward as borrowers, and it is therefore only fair to suppose that *if* they held their estates free from encumbrance they ought to have little or no difficulty in raising the money within the colony for improvement by the hypothecation of their property. The whole question may therefore be summed up thus: What terms and conditions would be required by the English capitalists likely to subscribe to such a loan, and, secondly, is there any other method of relieving the planters that would answer the same purpose?

In dealing with the first point, which turns upon the security that the planters are in a position to offer, it may be asked whether the borrowers as a body would mutually agree to guarantee each other's solvency and allow the local government to negotiate with a syndicate elected by the whole body of planters mutually guaranteeing each other? In such case the negotiations would be confined to the effectiveness of the guarantee and to the amount of interest to be charged for the advances. In Mauritius the usual interest on deposits in banks is 4 or 5 per cent.; good bills and mortgages would bear a charge of 7 or 8 per cent. and often more. But such a syndicate as above mentioned could probably borrow from the local government (who would make advances out of the loan to be raised in England) at say 6 per cent.

If, however, the Government of the Island were to deal separately with individual planters, it would have to investigate the financial position of each borrower, in itself a most intricate and invidious task; it would also have to charge a much higher interest, and if the borrowers should have previously encumbered their property it would be necessary that the local authorities should insist that such advances should form a first charge upon the security prior to all other creditors, this last condition being absolutely essential. Whether, however, the private creditors of an applicant for government assistance would agree to such a postponement of their claims would be a matter of doubt, although in the long run they would benefit by the superior earning power that improvements, if judiciously made, would give to the estates and plant.

We are not yet aware of the answer to the petition that the Governor is likely to give. Sir C. Boyle, we may feel confident, will feel it to be his duty as far as in him lies to use his best efforts to ensure the present and future prosperity of the colony, and if he is able to devise a more effective and simple remedy for the evil than the course suggested by the planters he may be trusted to adopt it.

And this brings us to the second point that we propose to discuss, viz., that of alternative expedients; one of them being the establishment of central factories, for which the country, being now fairly equipped with railroads, tramways, and traction engines, may be considered as well adapted.* Central factories are in successful use in many sugar-growing countries and worked on several systems: some as in Egypt are the property of the State, some belong to the local authorities as in Queensland, some to associated planters, to companies, and to private individuals.

It may be doubted whether the colony would become the actual proprietor of several central factories, or would adopt the alternative of building and equipping them, and then leasing them to manufacturers; but it might choose to grant concessions for such a purpose to an English or other company who would buy the cane from the planters and manufacture it. In any case the central system, whether supported by the colony as above defined, or worked by associations of planters, seems to offer greater benefits with fewer drawbacks than a system of loans to individuals, which must always involve considerable friction as well as be difficult to work without waste.

The great advantage it possesses is that it would at once relieve an embarrassed planter from the heavy outlay attending the conversion of the cane juice into sugar, and set him free to concentrate his whole time and capital upon the cultivation and improvement of the cane crop, while any leisure and spare capital could be devoted to the production of other crops, *e.g.*, tea, coffee, cocoa, &c. The central factory would automatically compel the planter to continually improve, as the payment would be computed in the direct ratio of the quality of the juice; the usine would also sell in larger quantities to the merchant, and the price would be less affected by the pressure heretofore often exercised by Arabs and others seeking to corner the markets.

The main point of the argument is this: the Mauritian cane growers will probably find more relief from their difficulties in abandoning the (to them) expensive manufacture of sugar, and limiting themselves to the cultivation of cane and other crops, which involve less outlay, and the quality and quantity of cane and sugar both would be improved by the division of labour. Surely this course is better than that of borrowing money, the repayment of which would be a heavy weight upon the resources of Mauritius for many years. The old adage about the borrower and the sorrower is often true, and we trust that the Cerneans and their excellent Governor will bear it in mind.

* We hear with much pleasure that the "sura" plague having practically disappeared, cattle are now being reintroduced in considerable numbers.

A COMPARISON BETWEEN DIFFUSION AND MILLING IN CANE SUGAR FACTORIES.*

By M. Leroy.

The application of diffusion in cane sugar factories dates back to the year 1876, when experiments in megass-maceration were carried out in the South of Spain. Introduced into the Indies, Cuba, Java, the Argentine Republic, &c., either for macerating the megass furnished by the mills, or for the direct diffusion of the sliced cane, this method of extraction has, nevertheless, failed to replace the older method of milling, which has been brought to a high degree of perfection since the introduction of triple mills, and crushers in conjunction with imbibition of water or of steam.

The principal objection to diffusion consists in the large dilution of the juice, necessitating an increased outlay in fuel, which is the more serious, because of the high prices of coal in tropical countries. But, in factories which have been specially designed for diffusion, it has been found possible to materially reduce the dilution and, consequently, the quantity of fuel burned by adopting more economic methods of heating the diffusion battery and by utilizing the hot water discharged from the Torricellian Column.

Moreover, whereas the diffused megass was formerly considered of little or no value as fuel owing to its high-water content and low sugar-content, it has now been rendered a highly satisfactory fuel by the introduction of the Huillard Drier, which has largely contributed to the reduction in the fuel account. As an example, we may mention the Usine Esther erected by the Fives-Lille Co., in 1905, in the State of Saô Paulo, Brazil. This usine diffuses the cane direct in a battery of 16 diffusers of 20 hectolitres capacity, which is fed by a cane-slicer furnishing 160 tons of cossettes (2 mm. thick) in 22 hours. The temperature is maintained at 95° in the first six diffusers, and 100 litres of juice are drawn off per 100 kilos of canes treated, which corresponds to an addition of 18 % of water and gives an average extraction of 96 % of juice.†

The exhausted chips are passed through a mill which extracts part of the contained water and they are subsequently dried in Huillard's apparatus, where, under the action of the hot flue gases, the percentage of moisture in the megass is reduced to 35%. The megass which finally enters the Godillot furnaces is, consequently, a fuel of high calorific value, and differing but slightly from wood fuel.

Having now described what constitutes a rational process of cane diffusion, we propose to determine the cost per bag of sugar and to compare this with the cost of working in a factory treating the same canes by double crushing and imbibition, the system generally adopted in Brazil.

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* Translated from the "Bulletin de l'Association des Chimistes."

† For a full account of this Usine see another page.

1. Mill Extraction by double crushing and imbibition.

We will assume that from 10 to 12% of water is added to canes of the following composition:—

Degree Baumé	10·0	Density	1073
Sucrose per 100 kilos canes	14·0	Purity	89·0
Glucose	1·0	Glucose coefficient	7·1

A factory equipped with a quadruple effet, without re-heaters, gave the following results:—

		Per 100 kilos. of Cane.
Sucrose entering the factory		14·00
,, lost during extraction = 18% of total =	2·50	
,, ,, ,, manufacture = 10% ,, =	1·40	
,, left in molasses .. = 9·5% ,, =	1·30	
Total	5·20	
Sucrose recovered as crystals..	8·80	
	14·00	14·00

In calculating the cost of manufacture, we will assume a crop of 15,000 tons treated in 72 days, which corresponds to an average of 210 tons of cane treated in 22 hours. With a maximum dilution of 12% the consumption of supplementary fuel will not exceed 10%, assuming a cubic metre of wood to weigh 500 kilos and to cost three dollars. Further, we shall take as basis a yield of 8·80 of chemically pure sugar.

TABLE I.

Canes treated	15,000,000 kilos.	
Days of work	72	
Yield obtained	8·80	
Sugar produced (by weight)	1,320,000 kilos.	
,, ,, (bags of 60 kilos. each)..	22,000	
	Expenses.	Receipts.
Cost of canes (at $8 per ton)	120,000	
,, fuel (at $0·6 per ton cane)	9,000	
,, manufacture ($3 per ton cane) ..	45,000	
Sale of sugar (22,000 bags at $14 per bag)		308,000
,, molasses (463 tons at $30 per ton)		13,890
Total..	174,000	321,890
Profit obtained	$147,890	

In the above table the cost of administration, as also the interest on Capital and Sinking Fund, are omitted.

2. Extraction by direct diffusion of the cane.

Assuming the canes to have the same composition as in Case 1, and that 100 litres of juice are drawn off per 100 kilos of canes diffused, corresponding to a dilution of 18%, a factory equipped with quadruple effet, without re-heaters, gave the following results:—

	Per 100 kilos of Cane.	
Sucrose entering the factory		14·00
Sucrose lost during extraction = 4·3 % of total	= 0·60	
,, ,, ,, manufacture = 10·0 % of total	= 1·40	
Sucrose left in molasses = 10·0 %	= 1·40	
Total	= 3·40	
Sucrose recovered as crystals	10·60	
	14·00	14·00

At the rate of 160 tons of canes diffused per 22 hours the total crop of 15,000 tons required 93·5 days. Admitting an increase of 50 % in the supplementary fuel as compared with mill extraction, this corresponds to 15 kilos per 100 kilos of cane. The cost of manufacture given above must also be increased by 18 %. This done, we obtain the following results.

TABLE II.

Canes treated	15,000,000 kilos.	
Days of work	93·5	
Yield obtained	10·60	
Sugar produce (by weight)	1,590,000 kilos.	
,, ,, (bags of 60 kilos each) ..	26,500	
	Expenses.	Receipts.
Cost of canes (at $8 per ton)	120,000	
Cost of fuel (at $0·9 per ton cane)	13,500	
Cost of manufacture ($3·6 per ton of cane)	54,000	
Sale of sugar (26,500 bags at $14 per bag)		371,000
Sale of molasses (498·5 tons at $30 per ton)		14,960
	187,500	385,960
Profit obtained	$198,460	

TABLE III.—RESUMÉ.

	Milling.		Diffusion.
Canes treated	15,000,000 kilos.	..	15,000,000 kilos.
Days of work	72	..	93·5
Yield obtained	8·80	..	10·60
Sugar produced (by weight)..	1,320,000 kilos.	..	1,590,000 kilos.
,, ,, (bags of 60 kilos.)	22,000	..	26,500
Expenses:—			
Cost of cane	$120,000	..	$120,000
Cost of fuel and manufacture	$54,000	..	$67,500
Receipts:—			
Sale of sugar..	$308,000	..	$371,000
Sale of molasses	$13,890	..	$14,960
Profits obtained	$147,890	..	$198,460
Profits in favour of diffusion			$50,570

SAVING OF FUEL IN CANE SUGAR FACTORIES BY MEANS OF THE HUILLARD APPARATUS FOR DRYING MEGASS.

By M. H. Pellet.

The cost of supplementary fuel (wood and coal) being generally high in countries where the sugar cane is cultivated, it is of prime importance that the sugar producer should diminish the expenses thus incurred.

At the present day little difficulty is experienced in burning the moist megass obtained direct from the mill by employing furnaces specially designed for this purpose. But, in factories operating by diffusion, the exhausted megass (or chips) contains so much water that a preliminary drying process is absolutely indispensable. This is most usually effected by exposure to the sun, a method involving a considerable amount of manual labour, and which is only practicable in countries where rainfalls are scarce during the crop seasons.

In the first case, as the moist megass from the mill is insufficient for steam raising purposes, there is the cost of supplementary fuel.*

In the second case there is the cost of sun-drying the megass, which is also considerable. In both cases a considerable economy in fuel is rendered possible by adopting the Huillard Drier, and from the results obtained at the Usine Esther (Brazil) and the Sucrerie de Naghamadi (Upper Egypt) during the past two years we are able to affirm that it offers a practical solution of the problem. As this apparatus is entirely automatic in action and utilizes the heat of the flue gases which would otherwise escape up the chimney, the cost of drying the megass is next to nothing.

In both of the usines mentioned the juice is extracted by the direct diffusion of the sliced cane (or cossettes). The exhausted cossettes, discharged from the battery, are passed through a mill which removes a certain quantity of water. Thus, at the Usine Esther, where a 5-roller mill is available for this purpose, the crushed cossettes (megass) enter the Drier containing only 70% of water. At Naghamadi, on the contrary, the existing mills furnish a megass containing from 80 to 82% of water.

The Working Capacity of the Huillard Apparatus.

A Drier having an internal diameter of 2·5 metres is amply large enough for drying the whole of the megass at the Usine Esther,

* Editor's Note.—This statement is not correct. With modern furnaces and water-tube boilers, the ordinary milled megass (containing about 50% of water) is sufficient not only for all the requirements of the factory, but also for the production of rum in the adjacent distillery. At the Usine St. Madeleine, Trinidad, the problem is rather how to utilize the surplus megass which accumulates in vast heaps in the factory yard.

where seven tons of cane are worked per hour, yielding say 2380 kilos of megass containing 70% of water. The megass passes out of the Drier with a mean water-content of 35%, which corresponds to the evaporation of:—

$$2380 \times \frac{70 - 35}{100 - 35} = 1282 \text{ kilos. of water per hour.}$$

At Naghamadi they have erected two Driers, each of 3·6 metres diameter, and in an experiment made with one of these and extending over 25 consecutive days, 7917 kilos. of cane were washed per hour yielding 4370 kilos. of megass containing 81·5% of water, and which, after passing through the Huillard Drier, contained 35% of water, which corresponds to the evaporation of:—

$$4370 \times \frac{81{\cdot}5 - 35}{100 - 35} = 3163 \text{ kilos. of water per hour.}$$

The Economy Effected.

The water evaporated in the Huillard apparatus must necessarily be evaporated in every sucrerie where the megass is used as fuel. Moreover, to-day almost every cane sucrerie is compelled to burn some additional form of fuel* by reason of the larger quantity of juice extracted and requiring to be evaporated. The megass being insufficient, the supplementary fuel may take the form of cane-leaves, wood, or, in some countries, coal. In each case it is therefore of interest to reduce the expenses incurred by utilizing the megass to the best advantage; in other words, by reducing the water-content of the megass to a minimum or to such an extent as will materially increase its calorific value per kilogram of dry matter burned.

By artificially drying the megass it is also more easy to regulate the stoking of the furnaces, as the quantity of moisture in the fuel can be kept relatively constant.

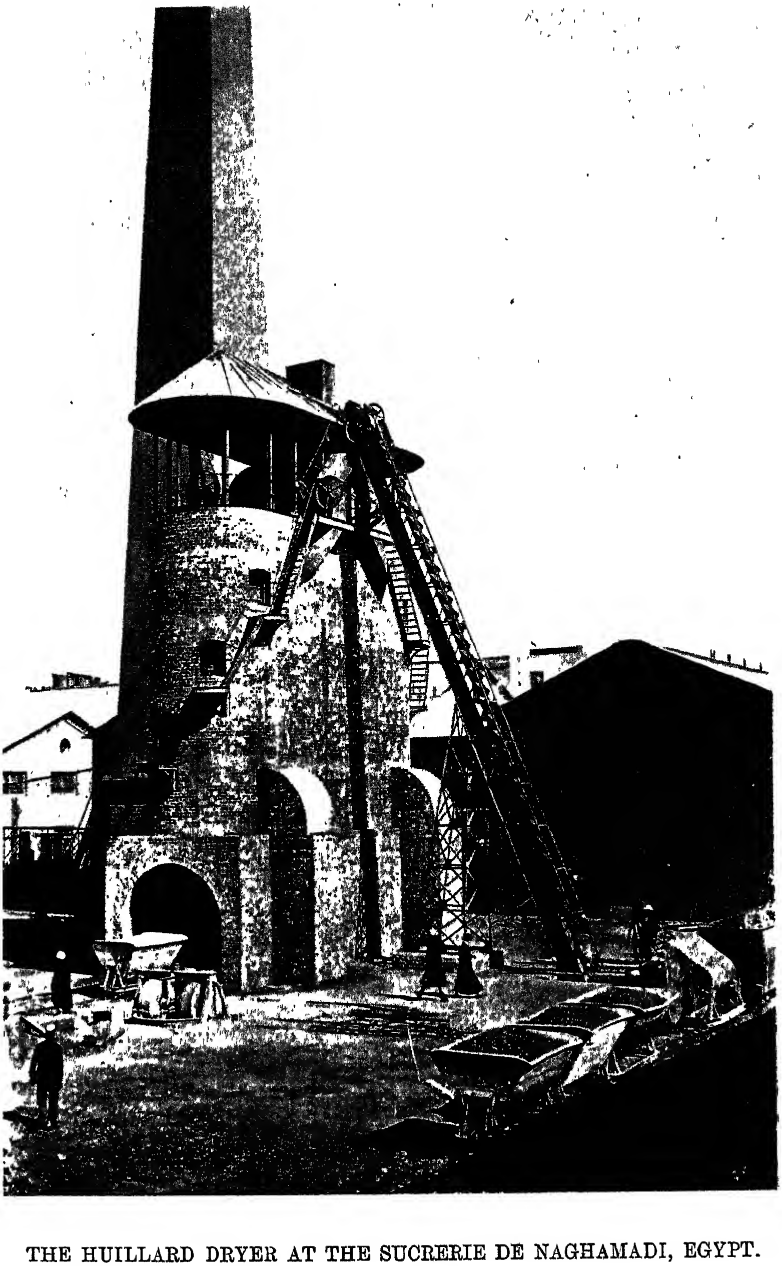
In the case of the Usine Esther, if the megass is not artificially dried additional fuel is required to evaporate the 1282 kilos. of water per hour or per seven tons of canes entering the factory. As one kilogram of wood is capable of evaporating three kilos. of water, and one kilogram of coal eight kilos. of water, we have:—

$$\frac{1282}{3} = 427 \text{ kilos. of wood; or}$$

$\frac{1282}{8} = 160$ kilos. of coal required per hour to supplement the megass. During a campaign of 20,000 tons of cane the adoption of the Huillard Drier would effect an economy of:—

$$\frac{20{,}000 \times 427}{7 \times 1000} = 1220 \text{ tons of wood, or } \frac{20{,}000 \times 160}{7 \times 1000} = 457 \text{ tons of coal.}$$

* See former note.



THE HUILLARD DRYER AT THE SUCRERIE DE NAGHAMADI, EGYPT.

A Drier of 3·6 metres diameter is sufficient for a factory working under the same conditions as the Usine Esther, and treating $\frac{20,000 \times 3162}{1282} = 50,000$ tons of cane, or about 400 tons per day, and the saving in fuel will amount to:—

$$\frac{50,000 \times 1220}{20,000} = 3050 \text{ tons of wood, or}$$

$$\frac{50,000 \times 457}{20,000} = 1142 \text{ tons of coal.}$$

The economy effected when operating upon ordinary milled megass may be calculated in the same manner, but as the amount of moisture will be much less than in the preceding case, one Huillard Drier will treat a much larger quantity of megass per hour. For example, with megass containing 65% of water, a Drier of 2·5 metres diameter is sufficient in a factory treating 210 tons of cane per 24 hours. A Drier of 3·6 metres diameter would suffice for a factory treating twice this quantity of cane. Similarly, with megass containing 60% of water, a Drier of 2·5 metres diameter would be sufficient in a factory treating 287 tons of cane per 24 hours. The foregoing figures are based on a fibre-content of 10% in the cane. If dealing with canes containing 11% of fibre, or more, the working capacity of the Drier will be still greater.

From numerous experiments which have been made with the Huillard Drier, it is to-day an easy matter to determine what size the apparatus should be for treating any given quantity of megass per hour, as also for treating megass containing various percentages of water.

It is of interest to note that even in the case of megass containing from 80 to 82% of water (*i.e.*, diffusion chips passed through a mill) the heat of the flue gases is sufficient to reduce the water-content to between 30 and 35% when the whole of the megass produced is passed through the Huillard Drier. It may therefore be said that, under ordinary working conditions, the heat escaping up the chimney would suffice for drying the whole of the megass passing into the furnaces.

Mr. Platt, a well-known planter in Natal, who claims to be the first agriculturist in that country to use a Fowler steam ploughing plant, is obtaining very satisfactory results therefrom. Under the old system, spans of 18 oxen, each doing half an acre a day, ploughed up the soil from 8 to 10 inches, whereas the steam apparatus loosens the soil to a depth of fully 2 feet.

THE MEYER & ARBUCKLE FILM EVAPORATION SYSTEM.

As briefly mentioned in a paragraph in our last issue, the Meyer and Arbuckle Film Evaporating Apparatus is reported to be giving good results when fitted to existing triples. Since mentioning the case of an estate in Trinidad where one has been so fitted, further details have come to hand, in the form of a report from the engineer of this property, on the working of the apparatus.

It was fitted to a well-known make of triple effect supplied in 1892, which was constructed to deal with 4000 gallons per hour. Since being altered, the triple has been able to deal with 8475 gallons per hour with little or no steam pressure. The amount of scale formed is, if anything, less than under the old arrangement; 30% maceration water is now used, allowing 80% extraction at the mills (treble crushing), as compared with the previous 15% maceration, the limit the triple could then deal with. The factory can now turn out 400 tons, all sugars, per week, as against 270 tons previously.

The following are some figures relating to this apparatus:—

Steam pressure on boilers	60 lbs. per sq. in.
,, ,, Calandria of first vessel..	0 to 1 lb.
Vacuum on vessels, first..	3 in. to 5 in.
,, ,, second	15 in. to 16 in.
,, ,, third..	25 in. to 27 in.
Heating surface of three vessels of triple ...	5300 sq. ft.
	Beaumé.
Juice entering triple	5·5
Syrup leaving	24·8

Specific Gravity.

$$\left.\begin{matrix}1{\cdot}0388\\1{\cdot}2040\end{matrix}\right\} = 80{\cdot}95\%\text{ evaporation.}$$

Per cent.
80·95 evaporation.
19·05 syrup.

100·00

Juice treated per hour	8475 gallons.
Syrup obtained	1614=19·05% of 8475 galls.
	6861 gallons evaporated.

68,610 lbs. ÷ 5300 H.S. of triple = 12·7 lbs. per square foot per hour evaporated.

It may be added that the engineer would doubtless be able to get even better results if steam pressure were introduced into the first calandria, but the engine which works the circulating pumps is only just powerful enough to give the present circulation of juice for the amount of exhaust steam available; an increased evaporation would need a brisker circulation. But doubtless the proprietor of the estate will give this matter his attention.

Finally, as regards entrainment, exhaustive tests which were carried out would appear to have shown a reduction in the amount of this loss by no less than 50%.

A POSSIBLE MISSION OF FERMENTS (MICRO-ORGANISMS) IN THE SOIL.*

By T. F. Sedgwick.

For a number of years I have been impressed with the action of citric acid upon soils containing a fair quantity of carbonate of lime. In trying to decide upon the proper strength of the solution of citric acid to be used in the determination of the so-called "available phosphoric acid and potash" in these Peruvian soils, a number of analyses were made, among which were the determination of these elements by adding enough citric acid to the soil to just neutralize it, and by adding enough to neutralize it plus 1% citric acid. Some of the results are here given:—

Parts per 4,000,000.

Citric Acid sufficient to neutralize Soil.

	1.	2.	3.	4.	5.	6.
Phosphoric acid.	288	400	372	274	312	560
Potash	260	476	172	316	112	208

Citric Acid sufficient to neutralize plus 1%.

Phosphoric acid.	1056	2240	2000	1092	1528	1400
Potash	560	600	636	404	200	1200

A soil was then analyzed for phosphoric acid only, by determining the water-soluble phosphoric acid, phosphoric acid soluble in ·5, 1, 1·5% citric acid, giving results as follows:—

Parts per 4,000,000.

	Per cent.
Soluble in water	37·6
„ ·5% citric acid	96
„ 1% citric acid	128
„ 1·5% citric acid	380

The theoretical amount of citric acid necessary to neutralize the soil was 1·2–1·3%.

These analyses indicate that a proportion of phosphoric acid in the soil, at least in the type of soil of the West Coast of Peru, exists in a very soluble form, is easily soluble in dilute citric acid, and as easily soluble as the carbonates which the acid neutralized; and that the amount of phosphoric acid dissolved under alkaline conditions increases with the amount of acid used, and is dissolved at the same time that the weak carbonates are being attacked.

It was also noted that on a soil containing a fair quantity of carbonate of lime, the alkaline reaction toward litmus or phenol increased, up to a certain point, as more acid was added; after this

* This paper was originally published in Spanish as a Bulletin of the Sugar Experiment Station, Lima, Peru.

point had been reached, the addition of acid decreased the alkalinity. This gives evidence that the compounds of calcium, magnesium, iron, &c., with citric acid, tend, up to a certain point, to increase the alkalinity of the soil.

It was further noticed that the total per cent. of CO_2 in the soil, after treatment with citric acid and allowing decomposition to go on as in Experiment I., was not materially changed, the per cent. of carbonates in the untreated soil being 3·9 and 3·7 in the treated soil, showing that the citric acid compounds on breaking up return to the soil such substances as calcium, magnesium, iron, probably in the form of carbonates.

Having observed, then, that some phosphoric acid exists in the soil in a very soluble form and is as easily soluble as the weak carbonates, and that the amount of carbonates in the soil does not vary materially under ordinary conditions, and considering that most healthy cultivated soils are neutral or alkaline although the root secretions and decaying material in the soil are supposed to be acid, it was a matter of interest to investigate as to why the elements (phosphoric acid in this case) are present in so soluble a form, and how the neutrality or alkalinity of the soil is controlled.

The following experiments were conducted with this in mind to observe the action of citric acid on soil containing a good amount of carbonate of lime. Alfalfa tops mixed with soil and water and allowed to decompose, acetic acid and tartaric acid had, under the same conditions, all produced effects similar to those produced by citric acid; and it is probable that most organic materials under like conditions would behave in a similar manner, so that it was assumed that citric acid is a representative agent either of the solutions given off by the roots of plants, or of decaying material in the soil, and that a mixture of citric acid and soil (as in Experiment I.) would represent in an exaggerated manner the behaviour of the secretions and excretions of plant roots, of decaying matter, and soil.

Experiment I.

200 grms. of soil were placed in a flask and treated with a solution of about 1% citric acid of a volume of 1 litre. This amount of acid was not sufficient to neutralize the carbonates and alkalinity of the soil. The flask A was set aside and contents allowed to settle. After 24 hours the liquid above the soil was found to be perfectly clear and coloured with compounds of iron. At the end of a week it had begun to become turbid.

A portion of the liquid was filtered off into bottle B and set away for about two months, during which time the turbidity increased and became very pronounced. At the end of four months the liquid was filtered and re-filtered, leaving upon the filter a reddish yellow and white precipitate while the liquid passing the filter was clear and

colourless. Treating the precipitate with dilute acid resulted in a strong effervescence and a dissolving of the precipitates. The solution of the dissolved precipitate contained iron, calcium, phosphoric acid, &c. The perfectly clear filtrate was found to contain acetate of lime for one of its chief constituents. The filtrate has been standing for three months and no perceptible change or turbidity has become apparent. When added to soil and decomposition allowed to go on, the soil originally brown showed the characteristic black colour of humus soil.

The solution of soil and liquid left in flask A was examined from time to time, and it was observed that the turbidity increased and decomposition took place much more rapidly in it than in the same liquid that had been filtered into bottle B. After a few weeks the soil in the flask originally brown showed the characteristic humus colour.

Experiment II.

200 grms. of soil were treated with a solution of citric acid of such a strength that all the carbonates and alkalies of the soil were neutralized and the solution contained an excess of ·5 to ·75% of citric acid, thus giving an acid solution to the soil. The solution and soil were allowed to stand for three months. It was carefully observed but no fermentation had taken place. Similar results were observed when acetic acid was used.

After three months a portion of the liquid was filtered off, C representing what remained in the original flask, and D the liquid filtered into bottle.

An excess of carbonate of lime was added to both C and D which made them distinctly alkaline. After a few days decomposition took place, indicating that although a ferment may be present in an acid environment, it grows and develops only under alkaline conditions. The decomposition was much more rapid and pronounced in C than in D.

Prior to adding carbonate of lime to C and D, a portion of D had been reserved, treated with carbonate of lime to make it alkaline, and nitrate of potash added. Decomposition set in in from 24 to 36 hours and the fermentation became very active.

Experiment III.

A soil was freshly treated with citric acid as in Experiment I., and allowed to remain in a flask 12 hours. A portion of the liquid was filtered off, E representing what remained in original flask, and F the filtered liquid. After a few days F was examined and no decomposition had taken place; carbonate of lime was added and still no decomposition; a slight turbidity appeared only at the end of eight days. On the other hand, E showed a distinct fermentation after only two days, which greatly increased when nitrate of potash was added.

This experiment indicates that the ferment or agent of decomposition does not quickly pass off in a liquid.

The above experiments may be generalized as follows:—

If a soil containing carbonate of lime be treated with citric acid and is still kept alkaline, a fermentation will slowly set up in the soil and solution showing that decomposition is taking place. If the fermentation is allowed to continue long enough, a deposit will be formed which, if obtained on a filter, washed with distilled water and treated with a dilute acid, will give the reaction for carbonates. This deposit will contain calcium, iron, phosphoric acid, &c. The liquid from the filtrate will be colourless and clear as water while the original citrate liquid from the soil is strongly yellow on account of the presence of iron. The clear liquid contains acetates, showing the change by fermentation from citrates to acetates. Upon standing for a long time it will not change. It is quite possible that if changes could be made to take place they would result in the final changes to the humus compounds. If the citric acid solution is allowed to remain on the soil for a number of months the soil will turn to the black of humus soils, showing that the decomposition leads to the formation of the humus compounds.

The deductions that may be drawn from these experiments and observations are that, for these soils, the compounds in the soil produced by the action of roots and probably other organic materials of the soil are broken up through the agency of growing ferments, so that carbonates are returned to the soil maintaining its alkalinity, and certain food elements in a very soluble form are liberated; that these ferments to develop and cause decomposition must have an alkaline environment; and that the rapidity of the decomposition is in proportion to the activity of the ferment.

Impressed by the behaviour of these ferments in the soil, I began to consider the possible mission of ferments (some ferments at least) as soil renovators. As soil renovators they offer a plausible explanation of some of the phenomena associated with the fertilization of soil, either by fallowing, rotation of crops, or the application of fertilizers, as may be briefly outlined in the following manner:—

The materials thrown off by the roots of plants are composed of compounds, or may form compounds, with the soil elements, which, in proportion as they increase, become detrimental to the plant. If the proper fermentation can be set up in the soil, decomposition of the compounds will follow, returning carbonates to the soil and liberating in a very soluble form certain elements necessary to plant life.

If the compounds are too greatly increased the plant will cease to grow. This is what happens, probably, when a plant is continuously grown on the same soil—it literally dies by reason of its own excretions. If nothing is allowed to grow on the soil and time enough is

given for the ferments to continue their full growth, even though slowly, the soil will in time be ready for the same crop again. This is what takes place in fallowing a soil.

If another kind of crop is planted on a soil long grown to one crop, the compounds it will cause to be formed in the soil will be of a different character to those caused by the previous crop. The new plant can live in the soil that was detrimental to the other because the compounds of the previous plant are not being added to, so that the ferments can now get the upper hand and develop causing decomposition which breaks up the compounds. It is quite possible, too, that what is given off by the new crop acts as direct food material to the ferment hastening decomposition. This accounts for the benefit derived by rotation of crops.

(A soil is not always immediately renovated by rotation. For example, in California it is almost impossible to make a fruit tree thrive in a spot where an oak tree has grown without first thoroughly renovating the soil, indicating that the soil has become so charged with compounds resulting from the growth of the oak that it will not sustain the life of the more tender fruit tree.)

If material can be added to the soil which will be a food to the ferment or make the environment conducive to the growth of the ferment, the noxious compounds will be quickly decomposed and the soil renovated besides having added to it a proportion of available plant food. When fertilizer is added to the soil to afford immediate food for the plant it may also serve as a fertilizer or food for the ferment.

It may happen that in applying fertilizer the proper fertilizer for the plant may be added but not one that encourages the growth of the ferment, in which case the fertilizer applied will not give the desired results. Complete fertilizing, then, is a twofold problem—to find out the direct food necessity of the plant and the food necessity or environment necessity of the ferment. Of the two it is more important to supply the necessity of the ferment than of the plant, since the compounds on decomposing will liberate food for the plant.

It may be said here, also, that to a certain extent some soils might be renovated by heating, as the effect of heat is to break up organic compounds. The soil in Experiment I., after fermentation had taken place, was found to contain acetates which were broken up when submitted to heat that was not strong enough to break up the carbonates. It has been observed, too, that certain elements in soil heated to 100 C. have been rendered more soluble. The long continuation of good crops in former years on the wheat fields of California may be partially accounted for in the practice of burning the wheat straw and stubble on the fields. Burning cane trash on the fields in many

sugar countries may partly explain the successful continuation of successive plantings. While heating a soil cannot be given as a recommendation for all soils, it might prove advantageous in particular cases, such as marshy soils and certain unproductive sub-soils. The only explanation to be offered for the failure of crops in some sub-soils (if they are in good physical condition) is that noxious compounds exist and must be broken up. This can be effected, as is usually done, by aerating the soil, which will afford opportunity for the ferments to grow. It may be that the ferments do not exist in that particular sub-soil and must be collected through exposure. If a sub-soil is heated, a fertilizer containing nitrogen should afterwards be applied.

These experiments and observations while by no means conclusive as to what actually takes place in the soil, are very suggestive and indicative and are given as additional data to any soil investigator who may be thinking in this direction. The work of this Station in other lines has been too pressing to permit of carrying out the investigations in a systematic and purely scientific manner. The investigations that would naturally follow would be to determine the compounds that are noxious * to a particular plant or class of plants, to determine the ferments that will most quickly decompose these compounds, and the conditions that will cause the rapid and active growth of the ferments. †

Sugar Experiment Station, Lima.

JAVA'S SUGAR INDUSTRY.

For some time past the attention of the sugar world has been fixed on the development of Cuba. As well from the importance of her existing production as from the vast prospects of expansion, Cuba merits careful consideration. There are however other cane-sugar-producing countries which deserve the same attention; of these Java is second to none. A study of the Java sugar industry is of interest, not only on account of its rapid growth within the last dozen years, but also and to a greater degree on account of the remarkable extent to which it has been aided by technical knowledge and skill, and of the extremely low net cost of production which is the rule. Viewed from the point of view of the world's price, we have here a factor of no small importance to consider.

* The idea of compounds injurious to plant growth being formed in the soil was suggested by the investigations of the Bureau of Soils, U.S. Department of Agriculture, as to the "toxic influences of plant excreta."

† The word ferment is used to mean the active micro-organisms in the soil.

The sugar production of Java for the last 11 years has been as follows:—

Year	Tons.	Year	Tons.
1896	534,390	1902	897,130
1897..	586,299	1903	931,286
1898	725,030	1904	1,055,043
1899..	762,447	1905	1,039,178
1900	744,257	1906	1,048,275
1901..	803,735		

We see that the last annual production only yielded an increase of 9097 tons, as compared with the previous year. After having roughly doubled between 1896 and 1904, the production has remained practically stationary since the latter year. Does this imply that the limit has been reached?

Having regard to the number of factories at work, the extent of Java's sugar production is an ample testimony to the highly concentrated system in vogue, a system which contributes largely to the reduction in general expenses and in the net price of the finished product. In 1906 175 factories produced 1,048,275 tons of sugar, or an average of 59,900 sacks (of 100 kg.) of raw sugar per factory. In 1905 the average for 172 factories was 60,000 sacks, and in 1904 for 176 factories 59,950 sacks. Nevertheless as compared with some other sugar countries, Java's figures are by no means exceptional. In 1905-06 the mean output per factory in sacks of 100 kgs. was: In Cuba, 71,000 sacks; in Denmark, 95,000 sacks; in Holland, 73,200 sacks; in Austria, 72,000 sacks; in Germany, 63,000 sacks; in France 37,000 sacks; in the United States (beet sugar), 53,000 sacks.

As to the area under cultivation in Java, Mr. Dickhoff estimated it in December last as 113,351 hectares (279,977 acres) for 1907 as compared with 110,463 hectares (272,843 acres) in 1906, and 105,393 hectares (260,320 acres) in 1905. The area under cultivation is therefore increasing from year to year.

And this cultivation, to judge by the results, is of the most perfect kind. In 1905 the yields of cane per hectare were: Western Java, 96,169 kg.; Central Java 91,566 kg.; Eastern Java, 96,256 kg., or an average for the whole island of 95,038 kg., as compared with 94,777 kg. in 1904. The highest individual figure yet achieved was in 1903 when 101,826 kg. was obtained. This is a case of intensive cultivation in the truest sense of the term, and these high yields have a great deal to do with the incredibly low net cost of production.

The output of the factories as regards quality has also undergone a great change within the last ten years. In 1896 8,282,351 piculs of 1st jet sugar and 740,363 piculs of "sack" or low grade sugar were produced. In 1905 the respective figures were 16,447,513 piculs and 756,459 piculs, showing that while the output of best sugar has doubled, the amount of low grade sugars turned out has not increased at all.

Java's yield per cent. on cane expressed in raw sugar is 10·5. Compared with this Germany yielded in 1905-06 15·28; Austria-Hungary 15·27, France 13·19; Java is however ahead of Cuba which, the same campaign, obtained but 9·86% of sugar on weight of cane.

But this seeming inferiority of Java when compared with Europe is more than compensated for by her greater cultural yield, inasmuch as her output of sugar per hectare far surpasses that of any European country.

In 1905 the average extraction of sugar per hectare was 10,078 kg. and 46% of the factories exceeded 10,000 kg., the highest individual production being 13,571 kg. In Europe the maximum yield in 1905-06 was obtained in Germany and amounted to 5096 kg. For the rest of Europe the average was no more than 3679 kg.

As showing the economy of production, the following figures will be found of interest.

One factory in 1905 worked up 1,118,016 piculs of cane (1 picul = 61·76 kilos or 136·16 lbs.) and extracted 115,824 piculs of 1st jet sugar at a net cost per picul as follows:—

	1905. Florins.	1904. Florins.	1903. Florins.
Staff expenses	0·69	0·64	0·72
Planting	1·85	1·81	2·10
Transport of canes	0·57	0·52	0·64
Heating and lighting	0·05	0·04	0·03
Manufacture of sugar	0·12	0·09	0·12
Packing	0·23	0·21	0·20
Transport and delivery	0·36	0·33	0·31
Various	0·27	0·29	0·21
Various purchases	0·04	0·04	0·04
Maintenance	0·19	0·13	0·13
Extraordinary expenses	0·05	0·08	0·02
Interest	0·13	0·04	0·17
	4·55	4·22	4·68
Francs per 100 kgs.	15·47	14·34	15·91
Per cwt.	6s. 4d.	5s. 10d.	6s. 5d.

In 1905 this particular factory obtained 7·45 florins per picul for its sugar as compared with 6·59 fl. in the preceding year. This gave a profit of 2·90 fl. and 2·37 fl. respectively, or 9·86 fr. and 8·06 fr. per 100 kg.

Another factory with a smaller output gave the following figures of cost of production :—1905, 5·73; 1904, 5·40; 1903, 4·89 florins per picul. The selling prices for those years having been 7·77, 6·36, and 6·18 fl., the profits were respectively 2·04, 0·96, and 1·29 florins per picul.

A third factory had the following results :—

	1905. Florins per picul.	1904. Florins per picul.	1903. Florins per picul.
Factory expenses	4·91	4·49	4·97
Selling price	7·14	6·59	6·10
Profit	2·23	2·10	1·13

A fourth factory in 1905 spent 5·22 fl. in working expenses, sold its sugar at 7·02 fl. and thus made a profit of 1·80 fl.

These factory results are the outcome of perfect cultivation of the cane and unsurpassed factory management, for which qualities Java is rightly famous.

A year ago a proposal was made to establish a manufacturing tax in lieu of the existing export duty. In spite of the protests raised by the manufacturers, it was finally adopted by the authorities and received the assent of the law. This new tax is collected from all factories of a capacity of 1000 piculs and upwards. It is based on the net profit, that is on the difference between the cost of production and the selling price of a picul of 1st jet sugar, "sack" sugar being calculated as half the value of 1st jet. If no profit is shown, then the tax is not collected. In amount it varies from 0·50 cents for a profit of 0·25 fl. per picul to 24 cents for a profit of 4 florins. It came into force in January, 1906, and was levied on the whole of the sugar from the previous crop, which had by the way obtained specially good prices.

The following table shows the exports of Java sugar for three years in metric tons:—

	1905. Metric Tons.	1904. Metric Tons.	1903. Metric Tons.
Holland	680	5,756	1,733
England	29,728	70,797	21,643
France	7	—	44
Europe	76	8	16
United States	83,385	263,132	185,489
British India	105,544	109,556	59,861
Singapore	52,664	45,384	48,678
Hong-Kong	248,007	176,906	240,026
China	14,833	2,852	6,564
Japan	138,555	144,551	137,140
Australia	18,036	14,268	67,369
In transit	—	4,176	39,640
,, (Portugal)	—	—	1,341
,, (Port Said)	298,054	183,414	59,456
Other Countries	60,826	30,724	1,703
Total	1,050,395	1,051,524	870,703

It will thus be seen that Java's best customers are British India, Hong Kong, and Japan. The exports to Europe have been of comparatively small importance. The State Railways grant special low tariffs to those factories which send their sugar entirely by rail to the port of shipment. The cost for a wagon-load of 8 metric tons is 9 florins per kilometer, or 56 florins for 180 kilometers. Cheaper classes of sugar obtain still lower rates.—(Abridged from the *Journal des Fabricants de Sucre.*)

THE B. 208 CANE AT PLANTATION DIAMOND.

Our statement in the May issue of this Journal, that the B.208 cane grown on the Diamond Estate in Demerara was not the original seedling variety of that designation, has aroused an unusual amount of criticism and protest in the Demerara and Barbados papers. The *Barbados Agricultural Reporter* has a leading article extending to nearly two columns, and obviously inspired, which after critically analysing every word of our Note, concludes that the statement is "ill-founded, unwarranted and, emanating from such a source, calculated to work mischief. It is therefore incumbent upon the *Journal* either to defend its position or to admit its error and revoke its disparagements." The Demerara *Daily Chronicle* publishes a letter from the manager of the Diamond Estate denying the allegations *in toto*, and our contemporary further proceeds to suggest that having regard to the hint given in our Note that there is lacking a proper spirit of co-operation between the planters of that colony and the Department in control of the seedling cane experiments, the identity of our informant is revealed in the person of the Head of that Department. As there seems to be a strong suspicion extant that Professor Harrison is responsible for this charge, we readily comply with a request received from him to state that neither he nor his staff have had anything whatever to do with the matter.

But though such is the fact, we must affirm what we stated briefly in our last number, that the correspondent who supplied us with the information to which so much exception is taken was stationed on the spot, and apparently had every reasonable facility for investigating the matter. Now a Journal which obtains information from all over the world cannot personally verify every statement it makes, and must needs trust to the accuracy of the correspondent who supplies the information. And as our correspondent was perfectly competent to form an opinion, we saw no reason to doubt the facts alleged. But as we are always ready to give the other side, we willingly publish these portions of Mr. Fleming's letter which are pertinent to the dispute. As however we did not personally originate the charges, we do not intend ourselves to attempt a detailed vindication of them nor to reply to the criticisms of the West Indian press; we must leave our informant to do that, and our one regret is that considerations of distance which separate him from us prevent us from immediately settling the matter. At the same time as we accepted responsibility for publishing the statements, we will at as early a date as we can either defend our position or admit the error and revoke our disparagements.

Mr. Fleming, the manager of the Diamond Plantation, wrote as follows :—

"It may be enough for me at present to state that the cane grown here as B. 208 was originally sent me by Sir Daniel Morris under that description, and that it has all the characteristics of that particular seedling, as given year after year in the sugar cane reports issued by the Imperial Department of Agriculture.

"Cuttings of it have been given by me to various planters in British Guiana, and none of them has ever told me that it differs in any way from the B. 208 canes received by them direct frem Barbados, or from the local Board of Agriculture. A few months ago, after Mr. Harrison had said that he doubted if the cane grown here as B. 208 was the same as that cultivated at the Georgetown Station, one of the members of the Board asked a friend of mine to procure from me some specimens, to send to the different estates under his charge, for purposes of comparison. As I have had no intimation to the contrary, they were presumably recognised as B. 208. Of course, it is possible that they may have fancied them identical with the White Tanna.

"I know the White Tanna cane, which was sent me from Mauritius three years ago; and it is unmistakably a different variety—a sport, as I was informed, of the big Striped Tanna cane—which I also got along with other kinds at the same time.

"Since the inception of the British Guiana Board of Agriculture, they have been furnished by Plantation Diamond every year with a list of the acreage in cultivation of Bourbon and other varieties of sugar cane, and were thus in a position to judge what kinds found favour on that estate. What was found impossible was to grind separately each of the numerous varieties of cane grown here, to test them, and to record results in the form requested by Mr. Harrison. Anyone giving the slightest thought to the subject would have known that a large factory, making seven to eight tons sugar per hour, and cutting canes in occasionally as many as twelve fields at the same time, with often six or eight different varieties in the mill-dock at once, could not afford to stop the mills, grind and test each variety by itself, every time it reached the factory.

"This plantation is worked for the benefit of the owners, is first and foremost a business concern, and only incidentally a scientific one, run for the information and guidance of the now Director of Science and Agriculture.

"Reference is made by you to the occasion on which the late Chairman of the Board of Agriculture, acting on erroneous information from his technical adviser fell foul of me in language ill becoming one gentleman to another. He subsequently apologised to me, and *de mortuis nil nisi bonum*. . . . .

"Sir Daniel Morris kindly furnishes me with any new and promising varieties grown by him, in order that it may be ascertained if they suit our local conditions.

"At different times I have had consignments of various kinds of cane from Hawaii and Mauritius, all of which have been carefully watched and tested to see if something could be found superior to what is usually grown here.

"On 31st December, 1906, of 7075 acres in cane cultivation at Diamond, only 1584 were in Bourbon, while 2676 acres, an area since increased, were in B. 208. This leaves 513 acres for the other British Guiana estates, so that so far no great harm can have come to them from trying a cane that has afforded consistently good results since it first began to be grown here.

"B. 208 has several well-recognized defects, and is far from being a perfect cane; but its good qualities overbalance its bad ones. I shall, however, have no hesitation in discarding it, when a better variety makes its appearance, as it doubtless soon will do, with so many competent workers striving for that end—more especially now that cross-fertilization is being practised in Barbados and Java.

"In the last resort, each planter must experiment and judge for himself as to the varieties that best suit his conditions. I have done so, and so far have no cause to regret that the results obtained have been at variance with the opinions published by the Board of Agriculture.

"I am, Sir, &c.,

"JOHN M. FLEMING.

"Diamond, May 27th, 1907."

We have also received a communication from Sir Daniel Morris who naturally feels aggrieved that there should be any dispute about the identity of seedling canes which originated from his Experiment Station in Barbados. After asserting that he has satisfied himself, after the fullest enquiry, that there is "no truth in any part of our statement," he concludes: "The idea of confounding the yellow cane B. 208 with the White Tanna, a reddish cane hardly known outside Mauritius, is an extraordinary one. You have a drawing of the latter in Deerr's Book facing page 64. A glance at this and at the drawing of B. 208, published in the West Indian Bulletin, Vol. VII., facing page 368, should at once have settled the question." But unfortunately for Sir Daniel Morris we are not so sure that it does, and for the following reasons. Subsequent to Mr. Deerr issuing his book, he accepted an engagement in Demerara, and while there he had occasion to examine some canes which were said to be White Tanna, and were derived from an estate which had originally procured them from Mauritius. Mr. Deerr, who may be considered a fair authority on Mauritius canes, did identify them as White Tanna. And yet their colour was a light yellow and not the reddish colour shown in Deerr's book. The difference in colour can probably be accounted for by change of climate and soil, for it has been noticed that Barbados varieties change their colour slightly after a few years' cultivation in Berbice. And Mr. Deerr has stated that in Mauritius canes of the same variety when grown at different altitudes vary in colour. So that as far as the question of colour is concerned we are not yet convinced that our correspondent is out of his reckoning.

Mr. Fleming's letter and the comments in the West Indian press seem to have brought out one fact with some prominence. There does not seem to be the same hearty co-operation between the Diamond Estate and the British Guiana Department of Agriculture as between the Department and the other Estates. The Diamond managers for reasons best known to themselves seem to prefer to keep their experiments more or less to themselves, and to apply to the Department of Agriculture in another Colony for technical aid and corroboration.

Into the reasons that lead them to adopt this attitude we do not propose to enter; we merely record what we believe to be a fact, and if our surmise is correct, then supposing the charges made in our columns against the Diamond canes are proved to be erroneous, we are bound to presume that they have been greatly aided in their inception by this lack of co-operation.

THE IMPROVEMENT OF THE SUGAR CANE BY SELECTION AND HYBRIDIZATION.*

By Sir Daniel Morris, K.C.M.G., and F. A. Stockdale, B.A.

(Continued from page 303.)

Hybrids in Barbados (*continued*).

Description of Hybrids.

Cross 1.—B. 1376 × B. 1529.—Owing to some differences in the three holes of the cross B. 1376 × B. 1529 it has been proposed to cultivate them separately under different nomenclature. The following are the characters:—

B. HH. 1 = B. HH. 3:—Colour, yellowish-green; habit of growth, recumbent; internodes roundish; eyes round; dried leaf-sheaths somewhat adherent; disease resistance fair.

B. HH. 2:—Colour, yellowish-green; habit of growth, upright; internodes variable; eyes round; dried leaf-sheaths fall readily; disease resistance fair.

All the canes from this cross were yellowish-green in colour, thus resembling the seed-bearing parent B. 1376, and not B. 1529, which is a red cane. The canes of two holes of this cross were recumbent in habit of growth, taking somewhat after B. 1376, while the canes of the other hole were upright—a characteristic of B. 1529. The canes were all above average size, therefore resembling B. 1376 rather than B. 1529, which is a thinnish cane; but they possessed internodes which resembled closely those of B. 1529. Two-thirds of the canes also resembled B. 1529 in that they had leaf-sheaths which were somewhat adherent to the stem.

Cross 2.—B. 3289 × B. 1529 = B.H. 15.—Colour, yellowish-green; habit of growth, upright; internodes roundish; eyes round; dried leaf-sheaths somewhat adherent.

The canes of this cross died early through the effects of the excessive drought that has been lately experienced and therefore the characteristics could not be closely followed.

* This paper was presented to the Conference on Genetics held in London in August, 1906, under the auspices of the Royal Horticultural Society.

Cross 3.—B. 3289 × *B. 1355* = B.H. 18.—Colour, yellowish-green, habit of growth, slightly recumbent; internodes variable, but generally roundish; eyes round; dried leaf-sheaths adherent; disease resistance fair.

The canes of this cross were drought resistant and resembled in colour and habit of growth B. 3289, in the shape of internodes B. 1355, but differed from both parents in possessing adherent leaf-sheaths.

Owing to the unfavourable season, during this last year, it was thought advisable to cut up all the canes available from these crosses and not to submit any of them to chemical analysis and, therefore, it is impossible, at present, to say what will be the commercial value of these canes. During this next year the characters of the hybrids will again be closely followed and recorded in order to see if any of them are variable.

SELF-FERTILIZED SEEDLINGS.

In 1904, several arrows of the better varieties were also bagged to obtain self-fertilized seedlings in order to investigate, if possible, some of the dominant characteristics of our different varieties of sugar cane. B. 1529 gave forty-two seedlings, which showed the following variations:—*

Weight of canes per hole—extremes		5 lbs.	to	47 lbs.	
Saccharose per gallon	,,	1·256	,, ,,	2·398	,,
Glucose per gallon	,,	·028	,, ,,	·139	,,

It also showed that its red colour was a recessive character, a fact which is borne out by the seedlings obtained by the cross between it and B. 1376. It might also be thought that its upright habit is also recessive, for the self-fertilized seedlings presented habits, recumbent to upright, in the ratio of 3 to 1. One of its dominant features is the inherent richness of its juice—a fact already noticed—when compared with the analyses of the juices of other seedlings grown under similar conditions.

B. 1376 gave twenty-seven seedlings that also varied considerably as may be seen by the following table:—

Weight of canes per hole—extremes		8 lbs.	to	50 lbs.	
Saccharose per gallon	,,	1·196	,, ,,	2·015	,,
Glucose per gallon	,,	0·39	,, ,,	·156	,,

It is impossible at present even to speculate upon its various characteristics, as the seedlings were so varied, but most of them were yellowish-green in colour and somewhat recumbent in habit of growth.

In all, sixty-nine self-fertilized seedlings have been investigated and, therefore, it may be held that the results above given have been deduced from a very small number, but they clearly show that much

* These figures were obtained from Prof. J. P. d'Albuquerque, Chemist-in-charge of Sugar Cane Experiments, and Mr. J. R. Bovell, Agricultural Superintendent, Barbados.

can be learnt about the inheritance in the sugar cane by inquiring into the dominant and recessive characteristics of the different varieties, and then it may be possible to build up an ideal cane.

General Conclusions.

In conclusion, it must be held, after careful examination of the various results, that the production of new varieties of canes by selection and hybridization has proved a valuable means of improving the quality of the sugar cane. The experiments carried on in the West Indies are most encouraging, for it has been shown that not only are the seedlings more resistant to certain classes of diseases through their increased vigour and growth, but that they also give a larger yield of sugar per acre; and the results from Java, Hawaii, Queensland, Louisiana, and elsewhere all confirm those obtained in these islands.

The success of the results already obtained should stimulate workers in this subject to greater efforts in the production of new races of canes, for it is not only necessary to improve the productiveness of the plant, but it is essential that races of greater disease resistance be raised, for whereas many of the seedlings at present are immune from one disease, they are more or less susceptible to another; and also that a large number of varieties be at the disposal of cane planters, owing to the great differences in climate and soils of cane-producing areas.

That climate and soil are the paramount influences exerted in the sugar-producing capacity of different varieties has clearly been shown by the difference in yields and other characteristics manifested by the same cane in different localities.

Therefore, following the example of European beet growers who think that the practice of persistently growing their crops under the same conditions of soil and climate is a mistake, the seedling canes are distributed in experimental plots on widely different areas and under different conditions. The seedlings are also grown in competition for a number of seasons before any definite conclusions are drawn as to their relative value, owing to the varying time of their maturity and the rapid deterioration of over-ripe canes, and the varying germinative power of the seed cuttings.

Whereas considerable improvement has been made by selection and natural hybridization, it is expected that hybridization under control should give desired results more rapidly, for by the careful choice of parents it is hoped to combine some of the good qualities of both parents in the off-spring.

The increasing fertility of the newer seedlings—as shown by the fact that recently nearly 1000 seeds from a single inflorescence have been known to germinate, whereas a few years ago thirty to fifty was the greatest number recorded—makes it probable that many of the

difficulties that have previously kept this work in check will sooner or later be overcome.

Probably the greatest improvement in the future will result from first analysing the different characteristics of the varieties to be used as parent canes by raising large numbers of self-fertilized seedlings and then building up an ideal cane, which will stand the rigorous tests of field selections, and analysis in the laboratory. In the carrying out of this work, great variations will be noticed owing to the hybrid origin of the varieties to be used for crossing purposes; but, then, by raising large numbers of self-fertilized seedlings, the heredity value of the parent varieties may be learnt from careful analyses of the off-spring. In other words, an examination of varieties of canes for the so-called "centgener power" of Hays may be of practical importance.

In short, "the great expectations once held of seedling canes may not have been realised," yet "the greatest hope for the future lies in the expectation that it may become increasingly practicable to raise canes of definitely known parentage from carefully selected plants possessing to the greatest degree the characteristics of disease resistance, high sucrose yield, heavy tonnage of cane, and the other properties which have been previously mentioned as marking a sugar cane of high economic value."—(Abridged from the *West Indian Bulletin.*)

CONSULAR REPORTS.

France.

Dunkirk.—The export of sugar to the United Kingdom from Dunkirk was less in 1906 by about 10,000 tons than in 1905, the total amount exported to all countries in 1906 being 72,137 tons of raw and 3495 tons of refined sugar. The following published results of the sugar industry in France up to the end of February, 1907, will be of interest:—

273 refineries have been working this season against 292 in the corresponding season of 1905-06. The estimated yield of refined sugar was 678,000 metric tons in 1906-07 compared with 968,747 tons in 1905-06.

The prospects of the coming beetroot season are somewhat doubtful. In some districts sugar beet will be replaced with beet for alcohol, and in others the area to be planted with sugar beet is expected to be increased. On the whole the area devoted to the cultivation of sugar beet is not expected to be much greater than in 1906.

Germany.

The campaign of 1905-06 witnessed a material growth of the activity of German sugar factories within the German customs frontiers as compared with the previous year. The meagre beetroot

crop of 1904 was followed by an exuberant yield of beets and the year of minimum production of sugar was succeeded by one in which sugar manufacturers attained hitherto unprecedented dimensions; during the last financial year the beet crop showed an increase of 5,700,000 tons in round figures, and the production of sugar a rise of roughly 800,000 tons.

The home consumption of sugar which manufacturers have endeavoured to raise by means of a reduction (not yet carried into effect it is true) of the sugar duty, underwent a conspicuous increase during the year 1905-06. The consumption per head of the population rose to 18·44 and 18·49 kilos. respectively, and setting aside the extraordinary figures of the campaign of 1903-04, represent the highest tide of sugar consumption.

Wholesale Prices of Raw Sugar during the Seasons from September 1st, 1904, until August 31st, 1906.

Month.	Year from— September 1, 1904, to August 31, 1905. Marks.	Year from— September 1, 1905, to August 31, 1906. Marks.
September	22·13	16·70
October	21·19	16·44
November	26·23	15·88
December	27·95	15·76
January	31·21	15·90
February	29·67	15·71
March	28·80	16·18
April	28·50	16·35
May	23·60	15·82
June	22·60	15·90
July	21·90	16·40
August	17·98	17·49
Average per season	25·15	16·21

NOTE.—Prices per 100 kilos., exclusive of consumption tax.

It will be seen from the foregoing table that prices fluctuated at the very outset of the season about a very low mean, and subsequently fell still further. It was only in the last month—August, 1906—that they began to grow firmer. The downward tendency of prices was determined principally by the pressure of supply due to the exceedingly favourable beet crop, but was furthermore effectively influenced by the collapse of big Paris sugar speculations. The refineries were likewise indisposed to commit themselves by large purchases, and merely covered their current requirements. As the factories had, in addition, accumulated heavy stocks of sugar in the hope of turning their products to more favourable account, even extensive orders from the East Indies were unable to bring about any

appreciable strengthening of the market. It was only after considerable transactions had been concluded with the United Kingdom and America and authoritative estimates decisively foretold a diminution of the sugar cane and beet harvest that drooping prices showed a marked improvement.

ROUMANIA.

There were five sugar factories at work in 1905-06 and they produced 28,585 tons (9854 tons more than the preceding year). The quantity exported was 4825 tons. The tax levied on consumption by the State was 6,509,930 fr. The premium of 16 c. per kilo. paid by the State on manufacture amounted to 4,242,178 fr., and, deducting this from the tax on consumption, there is a profit of 2,267,752 fr. to the Crown.

CHINA.

Hankow.—The Imperial Maritime Customs do not distinguish the origin of the sugars sent to this market. So far as can be gathered, Swatow sugars, on the whole, continued to fall during 1906, while the foreign sugar market was upset by the competition of Japan and Java with the Hong Kong product, prices showing since June, 1905 a loss of fully 30 per cent., and large stocks purchased at the old rates are still awaiting clearance. Arrivals of Japanese refined Formosa sugar are put by one native dealer at 60,000 against 10,000 bags in 1905, Hong-Kong refined at 40,000 bags, Swatow and Canton brown and white, direct and *via* Hong-Kong, at 172,000 bags—a decrease of 20 per cent. on the last two kinds. Of Szechuen brown sugar only some 4000 bags came, as the carriage and likin charges are almost prohibitive. German beet sugar is put at between 21,000 and 22,000 cwts., or double last year's figures, and German candy was much the same as in 1905. For cube sugar the demand was normal—it is too expensive to suit the natives—under 1000 cases of 20 6-lb. tins each.

Wuhu.—Foreign sugar continues to improve, the import being 257,498 cwts. against 193,387 cwts. in 1905. These figures must be taken with a certain amount of reserve, as the bulk of the sugar is not really foreign but is shipped from the southern ports *via* Hong-Kong, so as to be classed as goods of foreign origin and enjoy the special treatment secured for such goods. The quantities imported direct from the refineries in Hong-Kong amounted to 31,236 cwts., and from Japan 3445 cwts.; probably not more than 10,000 cwts. from these sources arrived through other channels. At the same time the import of genuine foreign refined sugar was three times that of the highest previous record. Hitherto the native consumers have had a predilection for their own sugar, which has a treacly flavour, giving it, as they imagine, a stronger sweetening power and thus rendering it more economical in the manufacture of sweetmeats, but there are now unmistakable indications that their taste has been rapidly educated to appreciate the superiority of the foreign refined

article, with the lower grades of which, in fact, they are no longer satisfied. In consequence, certain of these grades, which used to command a ready sale, have dropped out, the tendency being continually to call for a better quality. There is every reason to anticipate in the immediate future an astonishing and most satisfactory development of this trade, the one in which, as far as Wuhu is concerned, British merchants are most directly interested.

Portugal.

Beira.—The Zambesi valley, in which all the sugar grown in this part of Africa has hitherto been planted, would be an ideal locality for this form of cultivation, were it not for its extremely capricious rainfall. Due to this, the output in 1906 was disappointingly small. In 1904 as much as 7000 tons was shipped, whilst last year the total quantity produced sank to less than 5000 tons. This industry will, it is thought, receive a considerable impetus when, next year, a new and extensive undertaking, established on the right bank of the Zambesi and within the territory of the Portuguese Government, commences to crush the cane. This factory is now in course of construction, and is to have a manufacturing capacity of 8000 tons yearly.

United States.

Idaho.—Four beet sugar factories were operated in Idaho in 1906 with a capacity of 2650 tons daily, one in Washington of 500 tons and one in Oregon of 350 tons capacity. According to reports furnished by the owners, these factories produced during the season an aggregate of 72,648,000 lbs. of refined sugar, which is nearly twice as much as in 1905, when five mills were at work. The sugar was produced from 256,520 short tons of beets. Other mills will be opened during 1907. One difficulty the sugar factories have to contend with is in getting the farmers to cultivate beets, which involves more labour than some other branches of agriculture. The business seems to succeed best in irrigated districts.

Argentina.

The sugar output of the province of Tucuman was 101,000 tons and that of Salta, Jujuy, Santiago del Esterro and the Chaco 13,000 tons, giving a total of 114,000 tons. There was a large crop of cane, but owing to frost more cane had to be crushed to the ton of sugar than last year. All the sugar produced is used in the country.

Hawaii.

The 1906 crop of sugar is reported by the Planters' Association to have amounted to 429,213 short tons (one short ton equals 2000 lbs.), which is the largest crop these islands have produced with the exception of that for 1903, which exceeded it by about 8700 short tons. This production is divided among the islands as follows:—Hawaii, 137,750

short tons; Maui, 102,960 tons; Oahu, 113,750 tons; and Kauai, 74,753 tons.

Until the past year there had been no artificial irrigation of cane on the Island of Hawaii, dependence being placed entirely on the rainfall, which at times has fallen short of the requirements of the crop. Even yet there is little irrigation possible in that island, but in the Kohala district, where about 14,000 short tons of sugar were produced in 1906, irrigation has been made possible by the completion of a canal which conveys into the district and through the lands of the plantations at an altitude of about 1000 feet a considerable quantity of water gathered from the head waters of mountain streams. With this water it is the intention of the Kohala planters to irrigate considerable areas of land, hoping in that way to make sure of their crops and possibly to increase them.

This Kohala canal has a length of about 14 miles, in which there are 45 tunnels aggregating 46,000 feet, 20 flumes aggregating 2000 feet, and 23,000 feet of ditching, a total of 71,000 feet. This canal is 12 feet wide at the top, 7½ feet wide at the bottom, and 4½ feet deep, and it is lined with ¾ inch thickness of cement, capped on each side by 6 by 6-inch concrete rims. The cost of the work was over $400,000 (£82,262). The price paid by the planters for the water, which is measured to them over weirs from the canal, is $2500 (£514) per 365,000,000 gallons.

In the district of Hamakua, also on the Island of Hawaii, there is now being constructed a canal somewhat similar in character to that in Kohala, and there is talk of further cutting in that neighbourhood, the wish of the plantation owners being to have an abundance of water for the conveyance of their cane by flume to the factories, as well as some for irrigation purposes when the contour of the land makes irrigation possible.

On the Islands of Oahu, Maui and Kauai almost all cane is grown on irrigated lands. The water for this irrigation is obtained from artesian wells, from tunnels, or drifts, run into the face of "bluffs," and by means of canals which bring the supply of water from considerable distances where there are mountain streams or where the rainfall exceeds that of the particular districts in which the cane is cultivated. Apart from the Kohala canal above mentioned, there are canals of considerable magnitude on the Islands of Maui and Kauai as well as a few smaller canals.

One of the large canals on Maui, on which the large estate of the Hawaiian Commercial and Sugar Company depends for its water supply, is about 30 miles long and has a capacity of about 50,000,000 gallons. A new aqueduct recently constructed, 10 miles long, 7½ miles of which is tunnel, discharges into the older canal, which is at a lower elevation, and according to the constructing engineer, has a daily capacity of 85,000,000 gallons. Another canal on Maui has a

daily capacity of 30,000,000 gallons and is over 13 miles in length. It has 2000 feet of 36-inch siphon pipes, 3½ miles of tunnelling, and cost $185,000 (£38,252). One of the canals on the Island of Kauai, which was also recently constructed, has a daily capacity of 60,000,000 gallons, is 13 miles long, including 8 miles of 7 by 7 feet tunnels, and cost, completed, about $360,000 (£74,036).

A new electric plant was put in operation last year by one of the plantation companies in the Island of Kauai. The generating power is water, the intake of which to the aqueduct is at an elevation of 700 feet above sea-level. The aqueduct is 23,000 feet to the head of the pipe line. The pipes (of which there are two lines) are 30 inches in diameter and 1700 feet long, and the fall to the electric plant is 565 feet. The power developed at this plant is nominally 2400 horse-power, though the generators are capable of considerably exceeding this figure. The power is transmitted through aluminium wires to a plantation 34 miles distant, where it is used in the pumping of water and for other purposes.

The brief account above given serves to show to a certain extent the great expense which has been incurred by so many of the Hawaiian plantations in connection with their necessary water supply.

No change in the method of selling Hawaiian sugars has been made since last year, the conditions mentioned in the last report still continuing.

The basis of the price at which Cuban centrifugals are sold in New York continues to be that on which Hawaiian sugars are sold. The year 1906 opened with the basis at 3·625 c. per lb., and the highest point touched during the 12 months was 4·125 c. on September 20, from which date the price declined to 3·58 c. per lb. at the end of the year.

Considerable progress has been made of late by the Experiment Station of the Hawaiian Sugar Planters' Association in the contest with insect and fungus life injurious to sugar cane, particularly with that pest the "leaf-hopper" (*Perkinsiella saccharicida*, Kirk.).

Search has been and is being made successfully far and wide by the association's experts for enemies of these pests, and to such good purpose that in one case as many as 87 per cent. of leaf-hopper eggs were found to be destroyed in one favoured field.

The most valuable of the numerous destroyers which have been imported and are being regularly distributed are the four egg-parasites *Paranagrus optabilis*, *P. perforator*, *Anagrus frequens* and *Ootetrastichus beatus*, of which the first two appear to be the most effective locally.

In addition to these insect enemies, fungous diseases which attack the leaf-hopper and its eggs are being propagated.

If, as it is hoped, these enemies prove to be successful ultimately in combating the leaf-hopper, the result will be enormous gain to the territory, the loss from that pest since 1900 being estimated on the best authority to amount to millions of dollars.

Special attention is now being given to the destructive "cane-borer" beetle (*Sphenophorus obscurus*, Boisd.), for which it is hoped to discover some effectual natural enemy.

Owing to the increasing recognition of the importance of fungoid diseases of the cane, the organisation of a third division of the Experiment Station, that of Pathology and Physiology, was determined on by the association. In March, 1905, Dr. N. A. Cobb (late Pathologist to the Department of Agriculture, New South Wales) was appointed director, and by the end of August the organisation of the division was practically completed, the staff consisting of the director, assistant director and assistant.

New buildings were erected for the use of the division, and have been equipped with the most complete and modern apparatus. The microscopic and photographic arrangements are specially noteworthy, probably being amongst the finest in the world.

A plot of land, about three-quarters acre in extent, was secured for the special experimental work of this division, and in this one of the most important parts of the division's work, the study of the so-called "root disease," is being carried out. This disease is caused by the attacks of a basi-diomycetous fungus, and appears to be similar to diseases known in Java and the West Indies.

Considerable attention is also being given to the selection and preparation of cane cuttings for planting, treatment with disinfectants, such as Bordeaux mixture, being, as a result of the tests, strongly recommended. Some of the plantations treated the whole of their 1906 planting in this manner.

PUBLICATIONS RECEIVED.

L'ANALYSE CHIMIQUE EN SUCRERIES ET RAFFINERIES DE CANNES ET BETTERAVES. By Charles Fribourg. M.M. H. Dunod et E. Pinat. Paris, 1907. 12 fr. 50.

Chemists engaged in all branches of the sugar industry will welcome a treatise by such an authority as M. Fribourg, and dealing exclusively with laboratory methods. The title sufficiently indicates the scope of the work which is divided into three parts. First come the general methods of analysing saccharine products, including the determination of dissolved solid matters, mineral matters, sucrose and glucose. Then follows the application of these general methods in the analysis of the various products obtained in raw sugar factories and refineries. The third part deals with the analysis of non-saccharine materials used in the industry, including lime coal, animal charcoal,

and fertilizers. A short chapter is devoted to the methods of sampling the various products in the factory, but, in our opinion, this subject deserves more detailed consideration; accuracy in the laboratory being of little value unless the samples tested truly represent the bulk. The author's aim throughout is to explain the principles underlying the practical methods of the laboratory; the present volume being, in fact, a collection of the author's explanations to his own assistants in order that they might take an intelligent interest in their routine duties. His clear explanations and numerous examples of calculations will be appreciated by many chemists who are as yet unfamiliar with this special branch of analytical work.

BEET SUGAR MANUFACTURE AND REFINING. *Vol. II.: Evaporation, Graining, and Factory Control.* By Lewis S. Ware. 8vo., vi. + 647 pp., 225 figures. Cloth, \$5.00, or 21s. net. London, Chapman & Hall. New York, John Wiley & Sons.

(A review of this book will appear in an early number.)

DIRECTORY OF LOUISIANA SUGAR PLANTERS FOR 1907. Compiled and issued by the *Sugar Planters' Journal*, Poydras Street, New Orleans. 8 pp. Price \$1.00.

CATALOGUES.—*Centrifugals.*—Messrs. Pott, Cassels & Williamson, of Motherwell, Scotland, have recently issued a finely got up catalogue of 168 pages, quarto size, wherein are portrayed the large variety of centrifugal and crystallization in motion plants which they manufacture. Weston centrifugals naturally take up the chief space, and some 25 pages are devoted to a description of electric-driven machines. It would appear that this firm are now prepared to supply water-driven machines; but no details appear in the catalogue. It is fifteen years since Messrs. Pott, Cassels & Williamson embarked on the business of centrifugal manufacturers, and they have made very satisfactory progress, having now business connections in almost every country in the world. One has a suspicion that the American centrifugal manufacturers are finding their Scotch rivals too much for them, at all events in supplying neutral markets; and having regard to the high quality of work turned out by Glasgow engineers, we should not be surprised if this surmise were to prove correct.

In the first three years after the Brussels Convention the Glasgow sugar machinery trade is stated to have revived by 55 per cent. over the three years ending 1902, *i.e.*, before the Convention. Similarly the value of the plants supplied to the British refining trade for the same period after the Convention showed an increase of 78 per cent. over that of the years 1900-02.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of May, 1906 and 1907.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1906. Cwts.	1907. Cwts.	1906. £	1907. £
Germany	4,003,193	3,866,383	1,699,005	1,795,080
Holland	44,311	69,280	16,641	29,919
Belgium	200,665	178,220	81,209	79,061
France	158,805	168,574	67,251	84,304
Austria-Hungary	131,400	253,868	54,207	114,727
Java	158,997	64,194	73,466	33,230
Philippine Islands	....	69,569	....	28,500
Cuba	111,910	96,021	41,943	39,610
Peru	321,884	214,405	144,908	102,235
Brazil	874,250	184,743	342,359	76,276
Argentine Republic	....	....	....	....
Mauritius	52,523	282,806	20,368	116,614
British East Indies	30,877	15,824	11,742	6,403
Straits Settlements	36,962	88,329	15,807	37,057
Br. W. Indies, Guiana, &c.	835,890	815,413	480,917	470,248
Other Countries	144,263	432,519	66,198	215,294
Total Raw Sugars	7,105,930	6,800,148	3,116,021	3,228,558
Refined Sugars.				
Germany	4,763,525	5,459,113	2,714,253	3,196,830
Holland	1,106,189	1,147,190	657,497	715,645
Belgium	129,034	134,593	75,647	81,406
France	831,214	1,498,507	463,635	865,450
Other Countries	390	489	260	365
Total Refined Sugars	6,830,352	8,239,892	3,911,292	4,859,696
Molasses	1,144,516	1,140,802	218,332	217,428
Total Imports	15,080,798	16,180,842	7,245,645	8,305,682

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	127	192	114	125
Norway	7,323	6,553	4,422	3,883
Denmark	44,706	40,608	22,705	21,071
Holland	33,412	31,285	19,646	20,790
Belgium	4,129	3,970	2,224	2,363
Portugal, Azores, &c.	16,789	13,010	9,032	7,154
Italy	16,333	10,137	8,467	5,298
Other Countries	248,503	164,605	159,743	120,947
	371,322	270,360	226,353	181,631
Foreign & Colonial Sugars				
Refined and Candy	13,613	7,611	8,533	5,463
Unrefined	101,411	34,601	53,768	21,030
Molasses	5,175	4,031	1,590	1,161
Total Exports	491,521	316,603	290,244	209,285

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to June 20th ..	1,160,523	..	1,028,006
Receipts of Refined ,, ,, ...	420	..	1130
Deliveries ,, ,, ...	1,117,104	..	1,046,750
Consumption (4 Ports, Exports deducted) since January 1st..	861,140	..	856,290
Importers' Stocks, June 19th..	43,429	..	39,789
Total Stocks, June 26th	442,000	..	342,170
Stocks in Cuba, ,, ...	236,000	..	243,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1906 AND 1907.

(Tons of 2,240lbs.)	1906. Tons.		1907. Tons.
Exports	731,945	..	971,749
Stocks	323,206	..	372,045
	1,055,151	..	1,343,794
Local Consumption (five months)	19,480	..	19,870
	1,074,631	..	1,363,664
Stock on 1st January (old crop)	19,450	..	——
Receipts at Ports to 31st May..	1,055,181	..	1,363,664

Havana, May 31st, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR FIVE MONTHS ENDING MAY 31ST.

SUGAR.	IMPORTS. 1905. Tons.		1906. Tons.		1907. Tons.	EXPORTS (Foreign). 1905. Tons.		1906. Tons.		1907. Tons.
Refined	261,622	..	341,518	..	411,994	358	..	681	..	381
Raw	271,232	..	355,298	.,	340,007	1,039	..	5,071	..	1,730
Molasses	46,519	..	57,226	..	57,040	21	..	259	..	202
Total..........	579,373	..	754,040	..	809,041	1,418	..	6,011	..	2,313

	HOME CONSUMPTION. 1905. Tons.		1906. Tons.		1907. Tons.
Refined..	259,130	..	327,999	..	384,972
Refined (in Bond) in the United Kingdom	206,878	..	229,102	..	205,829
Raw	41,438	..	49,820	..	48,149
Molasses	45,854	..	55,044	..	50,756
Molasses, manufactured (in Bond) in U.K.	22,103	..	27,965	..	29,620
Total..................................	575,403	..	689,930	..	719,326
Less Exports of British Refined......................	8,451	..	18,566	..	13,518
Total Home Consumption of Sugar	566,952	..	671,364	..	705,808

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, JUNE 1ST TO 22ND, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1907.
199	773	522	440	139	2073

	1906.	1905.	1904.	1903.
Totals	2437 ..	1722 ..	2256 ..	2339

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING MAY 31ST, IN THOUSANDS OF TONS.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1902	1234	696	556	206	4594	4068	3939

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.	1903-1904. Tons.
Germany	2,250,000	2,415,136	1,598,164	1,927,681
Austria	1,335,000	1,509,870	889,373	1,167,959
France	755,000	1,089,684	622,422	804,308
Russia	1,450,000	968,000	953,626	1,206,907
Belgium	280,000	328,770	176,466	209,811
Holland	190,000	207,189	136,551	123,551
Other Countries	440,000	415,000	332,098	441,116
	6,700,000	6,933,649	4,708,758	5,881,333

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All Advertisements to be sent direct.

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The Editor will be glad to consider any MSS. sent to him for insertion in this Journal and will endeavour to return the same if unsuitable; but he cannot undertake to be responsible for them unless a stamped addressed envelope is included.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTICE TO READERS.—If the Advertisement pages stick together, bang their edges on the table, when they should easily separate.

NOTES AND COMMENTS.

The Fate of the Convention.

By the time this Journal is in the hands of our readers the Powers may have formulated their answer to the proposals of the British Government; but at the time of writing nothing definite is known. There have naturally been no lack of rumours and surmises, but as these have not by any means been unanimous, it is an open question what form the answer of the Powers will take. On the one hand there seems to be some good ground for the allegation that the other Contracting States to the Convention are inclined to give in to the British demand as a temporary expedient rather than allow the sugar market to be needlessly upset. On the other hand, it is clear that if the Governments concerned yield to the solicitations of their sugar manufacturers, they will necessarily have to refuse to accept the new proposals and will throw on the United Kingdom the responsibility of taking the next step and denouncing the Convention. As to the attitude of the British Government, it is really a case of wishing to have their cake and eat it. They are not genuinely anxious to end the Convention, as they realise that it has done some good in dealing

with the Cartel bounties at least; but they have got a cut and dried system of free trade to uphold and before this fetish every other consummation must give way. They hope the Powers will prove less firmly attached to economic principles, and will stretch a point in their favour. If they do not, then the British Ministry will be in something of a strait.

Of these two alternatives, we think the lesser evil will be for the other Powers to give in. We have already shown that England's present attitude is not that of the nation as a whole, but merely of a party which when it once goes out of office is never likely to come into power again save under very different ideals. It is therefore well worth waiting a year or two till the opportunity is more favourable for renewing the Convention on a fairer basis. Whether the foreign Governments realize this and are content to act on it, the next few weeks will show. In any case before our next number is out, the "Ides of March" will have come, in other words, the 1st of September; and if no notice of denunciation has been lodged at Brussels, the Convention will be automatically extended till August 31st, 1909.

Petitions relating to the Convention.

A Parliamentary White Paper issued last month reproduces no less than 27 representative letters from private and public bodies all over the British Empire addressed to the Secretary of State for the Colonies on the subject of the Brussels Convention. First comes a pertinent enquiry from the New Colonial Company, who point out that they are being required by the Trinidad Government to erect a hospital for coolies at an estimated cost of £4000, and showing that in the event of the Convention being denounced the sugar industry in that colony would suffer so severely from a recrudescence of the Cartel bounties that such a hospital as is contemplated would cease to be required in two or three years. The firm therefore ask for information as to the Government's intentions. Next follow several letters from Colonial Governors who transmit petitions from local associations praying for a continuation of the Convention. These include the Leeward Islands, Jamaica, British Guiana, Barbados (where a petition was drawn up by the Legislature as well as by public bodies), Straits Settlements, Vancouver (Board of Trade), Sierra Leone, Mauritius, Trinidad, Natal, and Hong Kong. Besides these, several Chambers of Commerce wrote direct. Such were: Orange River Colony, Pietermaritzburg, Geelong, Maryborough (Queensland), Liverpool, and Auckland. This is a very representative list, practically every one of these petitions coming from places which have had experience of the requirements of the sugar industry. It is to be hoped that due weight will be given to them by His Majesty's Ministers. There are, however, no instances of replies given in this Paper; whether any

were sent by the Colonial Office is doubtful, as they would hardly disclose their intentions beforehand.

To quote two instances from the list, the Northside Sugar Planters' Association, of Jamaica, asserts that it "would be against the principles of fair trade and free trade to allow the importation of bounty-fed produce from foreign countries on the same conditions as the produce of British colonies," and further points out that "much capital has been laid out in up-to-date machinery . . . and much more capital will be forthcoming to continue the modernizing of manufacture if present conditions continue, as we realise that we can hold our own if given a fair field and no favour," whereas they are certain that if bounties are re-introduced the abandonment of sugar estates would follow throwing out of employment thousands of labourers. Barbados points out that their population, amounting to nearly 200,000 inhabitants mostly of the agricultural class, still depend for their subsistence on the sugar industry in spite of the recent revival in the cultivation of cotton. "Since the Convention has come into operation, the beneficial effects of the stability of the industry . . . are shown by the purchase of estates at improved prices not only by local buyers but by investors from England and North and South America, by the efforts of proprietors to make a higher and better class of sugar than formerly, involving the introduction of new and improved machinery. . . . The effect of the withdrawal of (the) Government from the Convention would assuredly be to thrust back the sugar industry to the moribund state in which it was found at the time of the Royal Commission of 1897."

We have quoted enough from these letters to show that opinion in the sugar colonies has been unanimous in claiming the Convention as a benefit to their industry, and its cessation as an impending calamity. It will not be so easy now for free-traders at home to allege that the Sugar Convention has been of no use to the colonies. The latter ought to know best, and they have done wisely in making their opinion known at the Colonial Office.

The Abandoned Beet Sugar Industry in Lincolnshire.

As we briefly mentioned in our Notes last month, the project to erect a sugar factory at Sleaford has had to be abandoned for the present owing to the Government's uncompromising attitude towards the Brussels Convention. The existence of the Royal Agricultural Show at Lincoln this year enabled the holding of a meeting to discuss the matter, at which many leading agriculturists were present, including Lord Denbigh. It was elicited that the plans for the factory had been all but complete. Provisional contracts for 2,000 acres of beets had been entered into with the farmers, exceptionally low railway rates had been secured, an ample water supply had been found, and the committee of guarantors had decided to proceed with

the erection of a factory capable of dealing with 50,000 tons of roots. Numerous applications were made for shares in the new concern, and a number of most influential people representing landowners, farmers, and business men had consented to act as directors. One firm had offered to take a large number of shares on condition that they were given all the beet slices to make into cattle food. Everything, in fact, was proceeding most satisfactorily till Sir E. Grey's announcement in the House of Commons altered the whole situation and led to the temporary abandonment of the scheme. The chairman of the meeting, however, added that the scheme was not absolutely dead, and that at some date in the future the industry would be started and become profitable.

The Sugar Tax.

The Government did not carry that part of the Budget relating to the sugar tax without suffering some anxiety. Their majority in carrying the tea duty was less than 60, and, as no fewer than 156 Liberal members were alleged to have promised their constituents at the last election that they would vote for the abolition of the duty, the prospects of a Government defeat were not remote. But when it came to putting the matter to the test, nearly all these promises went by the board, and in the end the Government secured a majority of 137. They undertook to abolish the duty at the very first opportunity, and in view of this promise the 156 recalcitrants evidently thought it better to save their party's skin at the expense of their election pledges. So, much to the wrath of the sugar users, the duty is confirmed for another year. It is said, however, that when the result of the voting was known, many of those who had promised to vote against the tax professed indignation at the way they alleged they had been taken in. Had they known the majority would be so large they would have voted the other way, and thus have reduced it to much smaller dimensions. As it is, the whole thing shows up amusingly the value of election promises and their subsequent interpretation.

The West India Committee.

The annual report of the West India Committee for 1906 shows that this association is in a flourishing condition. The total membership is now 1152. The balance of assets over liabilities on December 31st last was £373 3s. 2d. This is not a large sum, but, considering the amount of information and the number of publications given to the members for their annual subscription of one guinea, it is a wonder that the institution is not actually in debt. We notice that the Committee propose to strengthen their financial position by instituting an endowment fund. We think, however, that a decision to raise subscriptions by half a guinea would be a much simpler

expedient, and would command more success than an appeal to charity. If the work done by the Committee, and the information given to its members through the columns of the "Circular" is worth having, it is also worth paying for; and we think the subscribers already get more than their guinea's worth.

British Equipped Sugar Factories for Formosa.

We learn that one of the latest orders for a central sugar factory to be erected in Formosa has just been placed in Glasgow. It is for the Meiji Sugar Manufacturing Co., of Tokyo, and is to be fitted with all the latest improvements as regards machinery for the most economical method of manufacturing cane sugar, and is to be capable of making 80 tons of sugar per diem. This will comprise grey sugar for refining purposes, and yellow crystals for direct consumption in Japan.

This order has not been placed without careful consideration. The Japanese firm sent a sugar expert on a tour round the sugar engineering works in Europe and America, and after considering various specifications, plans, and estimates submitted to him, he decided that those tendered by the Harvey Engineering Co. Ltd. were the best. This engineering firm have therefore secured the contract, which is the fifth central factory they have obtained an order for within the past twelve months. It is interesting to note that this order coming from an outside country was competed for by most of the leading firms in the sugar machinery business all over the world, and it is certainly to the credit of the Glasgow firm that they secured it. It is to be observed that most of these orders for central factories which have gone to Scotland the last few years have only been rendered feasible owing the security engendered by the Brussels Convention, and it is sincerely to be hoped that the Government will give due weight to the extent of the revival in such trade which the Convention has brought to British sugar machinists.

Prospects of Beet-Growing in Corea.

The British Consul-General of Seoul has forwarded a translation of an article that appeared in a local Japanese newspaper, dealing with the results obtained from the experimental cultivation of sugar-beet in Corea and the prospects of its successful production for commercial purposes. It is estimated that in spite of the lack of experience a crop of 12 tons per acre with a sugar proportion of 10 per cent. will easily be obtained, and that as experience is gained this estimate will be greatly exceeded. The Japan-Corea Sugar Manufacturing Company intend to grow part of their material on their own estates, and purchase the remainder from tenant-farmers. The farmers, who will be partly Japanese and partly Corean, will receive seed and implements from

the Company, and will receive instruction in the methods of cultivation. In accordance with Corean customs, half the crop, after deduction for land tax, will be the property of the tenant. That part of the raw material produced by the Company will be grown on model farms.

It is calculated that beet cultivation is the most profitable crop that could be grown in Corea. In addition to the manufacture of sugar, there are three side industries that could be carried on with profit by a beet-growing concern in Corea, viz., (1) the manufacture of alcohol from the molasses; (2) stock-raising; and (3) the cultivation of barley, rye, potatoes, &c. The climate and other conditions of Corea are admirably suited for stock-raising, which could thus be made an important secondary industry in connection with beet-growing. Again, the necessity for proper rotation of crops would provide excellent ground for the growing of barley, rye, beans, potatoes, &c. The barley might be converted into malt for brewing purposes, and would find a ready market.—*(Board of Trade Journal.)*

Sugar Duties in Natal.

The following list gives the additional duties now leviable on bounty-fed sugars entering Natal as fixed by the Natal Customs Union:—

Country.		Rates of additional duty on Bounty-fed Sugar. Raw. s. d.	Refined. s. d.
Denmark	per 100 lbs.	0 7½	1 3
Spain	„	9 8½	9 8½
Japan	„	—	0 11¼*
Argentine Republic	„	5 5	3 9* / 7 2†
Roumania	„	5 6	7 3
Russia	„	2 2¾	2 11¼
Chili	„	2 1¾	4 9
Nicaragua	„	12 6	12 5

According to F. O. Licht, the permanent Assembly of the German Ministers of Agriculture have been petitioning the Imperial Chancellor that in case Great Britain decides to denounce the Convention, Germany may be permitted to take the same step. They do not hold it to the interest of the German sugar industry to grant Great Britain the exceptional position in the Convention of being permitted to import premiumed sugar free of duty. They further express the wish that the excise tax on sugar might be reduced from 14 mks. to 10 mks., especially in the event of the Convention falling through.

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* Candied. † Other.

THE DENUNCIATION OF THE BRUSSELS CONVENTION.

We have already given abstracts of the views expressed in France, Germany, and Austria in regard to the remarkable and unjustifiable action taken by the British Government in their attempt to beat an ignominious retreat from the engagements entered into by this country at the International Conferences held in Brussels in 1901 and 1902. We now have a further and most important addition to these views from the competent pen of M. Fr. Sachs in the *Sucrerie Belge* of the 1st July. His review of the situation is so complete and accurate—so full of valuable information and acute criticism—that it deserves the most careful analysis, and the fullest possible publicity in this country, where statements of the facts are so constantly stifled by fictitious inventions.

M. Sachs devotes 18 pages to his examination of the whole question, and there is not a word wasted; but we must try to give, in brief, a sufficient abstract of the essay to enable that great majority who persistently refuse to read, preferring fiction to fact, to listen for once to the voice of sober reason and common sense. If even one member of the Government could be induced to hear what M. Sachs has to say there might be some hope of a saner policy on the sugar question.

M. Sachs regards the declaration of the British Government as a fact of the utmost gravity for the whole sugar industry of the world. All the countries of Europe, and some of those beyond the seas, have sustained their sugar industries by bounties, either for the purpose of protecting a rising industry against foreign competition, or, in the case of those already over-developed, to secure for them the profitable exportation of their excess production, even at a low price, while maintaining a high price for home consumption. Theoretically bounties are to be condemned, the interest of the consumer being that sugar, like every other commodity, should be produced where its production can be carried on most economically. Practically, however, it has been found necessary to support the agriculture of the State against cheap outside competition; and when one State gives a bounty it is necessary for all the others to follow the example. Bounties have also had the advantage of checking the development of the cane sugar industry, which can, in many countries, produce more successfully even than the beetroot industry which enjoyed a bounty.

But the bounties have had their disadvantages. They have involved higher duties, which have checked consumption. The working classes have benefited by the prosperity of the industry, but have been injured by the high price of an essentially nourishing food.

Moreover, the United States and British India declared war against the European bounties and levied duties to countervail their effects. England was disposed to do the same, and then bounties would have

failed of their object and would have merely added to the revenue of the great consuming countries at the expense not only of the consumers but also of the sugar industries of Continental Europe.

Bounty-fed sugar, even under existing circumstances, began to suffer from an unexpected enemy—the exaggeration of the bounties, especially by means of the Cartels of Germany and Austria. The price fell to such a ruinous figure in 1901 and 1902 that all the advantage resulting from bounties disappeared and went to benefit the importing countries. Those who enjoyed the big Cartel bounties were anxious to continue the unequal contest, but the majority of the countries were ready for the international Convention and their will prevailed.

There was some desire that Russia should take part in the Convention, but it was recognised that in any case, though shut out of the English market, Russian sugar could go to other parts of the world, so that there would merely be a substitution of one sugar for another and the effect would be the same as if the sugar were admitted direct to the English market. Happily the Russian Government modified their sugar legislation, which no longer compels the manufacturers to export the excess of their production. Since then only small quantities of Russian sugar have been thrown on the European markets, and in some instances German sugar has even been imported into Finland and Central Asia when Russian sugar has been unobtainable.

M. Sachs pointed out five years ago that the maintenance of Russian bounties under the new legislation could not hinder the action of the Brussels Convention, and events have fully confirmed his anticipation.

As to the increase in the production of cane sugar in Cuba and Porto Rico, that is entirely due to the United States preference and is quite independent of the Brussels Convention. The competition resulting from this increase has been neutralized by increased consumption in European countries arising from the reduction of duties. This reduction should be pushed further.

The Convention has created a more stable situation for the industry in all countries, and producers are now independent of the uncertain favour of Governments and Parliaments. They have become accustomed to the new order of things and have regarded any return to the old régime as absolutely impossible.

In our peace and quiet the declaration of the English Government has struck us like a thunderbolt.

What are the motives impelling English ministers to destroy the work of their predecessors? M. Sachs can find nothing in the English declaration to justify such action. He finds two reasons only:—

1. The interests of the sugar consumer.
2. The interests of the sugar-user.

He quotes the Board of Trade figures of the exports of sugar and confectionery in 1904–6 compared with 1901–3, and fails to see that the Convention has had any unfavourable effect on these exports.

As to the effect on the consumer, he shows the hollowness of the pretence that the want of sugar from Russia, the Argentine Republic, Denmark, Spain, and Roumania can have had any effect on supply or price. During the last two years the average annual exportation from Russia has been under 100,000 tons, and has been barely sufficient to supply the customary demands in Finland, Persia, and Central Asia. In 1905 the Argentine Republic had only 2129 tons for export, and in 1906 only *six tons*. Denmark had 11 tons in 1904, 28 tons in 1905, and 13 tons in 1906. The largest export that Spain has had during the last nine years is *seven tons*, except in 1905, when she exported 6153 tons. Roumania exported 482 tons in 1904, 4491 tons in 1905, and 2792 tons in 1906. And yet our Ministers repeat in Parliament the parrot cry that the high prices in 1905, when we had a shortage of 1,200,000 tons in the beetroot crop, were caused by our shutting out sugar from these five countries, all of which had practically no sugar to offer us. These are the reasons, and the only reasons, for denouncing the Brussels Convention.

But there is no doubt that the want of sugar for export in Russia during the last few years is only temporary, and we know that the production in 1906-7 was enormous. There is no direct bounty in Russia, but by limiting the sale of sugar for home consumption and compelling the exportation of the balance an artifical advantage was created which made it possible to export even at a loss. Russian sugar thus became a serious competitor against the industry of other countries, not so much because it enjoyed an indirect bounty as because of the obligation to export. But directly the Russian Government ceased to compel producers to export their excess it was possible to find a means for Russia to join the Brussels Convention.* The Convention renders such an exaggerated fall as that of 1902 practically impossible and, therefore, it is to the interest of the Russian Government to take a step in that direction. Moreover, Russia has no need to export to Western Europe. Her exports go, normally, to Finland and Central Asia. Russian sugar enjoys a large preference in Finland, and in Central Asia the benefit of geographical position. On the other hand exportation to Western Europe involves heavy freight charges. The Government recognised these facts when modifying the legislation a few years ago. They made a distinction between "useful" exports (to Finland, Central Asia, &c.) and those which were really excessive. But even these the producers were not obliged to export, but could carry over to the following year and add to their

* This we ourselves pointed out in the *International Sugar Journal* for April, 1907, p. 166, in an article entitled "The Governmental Regulation of the Russian Sugar Industry," in which we indicated a way out of the Russian difficulty.

contingent. Thus they could not only avoid loss by export, but could also reduce their production without reducing their contingent. The manufacturers, therefore, have no inducement to export to England even if the Convention ceases to exist. The excessive production of 1906-7 is exceptional owing to an abnormally favourable season.

M. Sachs adds that the Russian Government fails to appreciate the real situation, since it tries to force England to admit Russian sugar by surtaxing her Indian tea. He is evidently unaware of the facts stated by Sir Charles Elliott in *The Times* of June 28. The duty on tea was increased in Russia's western ports, but lowered at Dalny and Vladivostok in order to increase the traffic of the Manchurian railway. The Indian exports of tea to Russia have consequently increased from two million pounds to over seven millions.

Instead of putting pressure on England to admit Russian sugar, which would be of no advantage to Russia, the Russian Government would do better to negotiate with the Parties to the Convention and assist them to continue a work useful for all and in no way injurious to Russian interests. The Powers, it is to be hoped, will understand, on their part, that it is to their advantage to come to an understanding with Russia on the basis of her present legislation.

Those who fear a considerable importation of Russian sugar into England fail to see that if there be an exportation to Europe it can go to other European countries, not parties to the Convention, and have exactly the same effect on stocks and prices.

M. Sachs proceeds to criticise the claim of the British Government that they should enjoy exemption from certain stipulations of the Convention just as Italy, Sweden and Switzerland do. He points out that the cases of Italy and Sweden are not parallel with that of England. They are permitted to give bounties so long as they do not export. As to Switzerland, she is in no way exempted from levying countervailing duties on bounty-fed sugar.

The claim made by England cuts at the very root of the Convention. Hence the *Deutsche Zuckerindustrie* is of opinion that the English proposal is inacceptable to the other contracting States. All the Powers, and especially Switzerland, will no doubt demand a surtax on English sugared products and on English refined sugar.

M. Sachs quotes the *Centralblatt* of Magdeburg and the *Prager Zuckermarkt* to the same effect. The quotation which he gives from the *Journal des Fabricants de Sucre* is even stronger and urges that as Great Britain has thought fit to reject the fundamental principle of the Convention, which is in great part her work, her presence in the Convention is useless and is even dangerous for the other States.

M. Sachs thinks, therefore, that it would be better for the English Government to reconsider their decision and make proposals more in conformity with the spirit of the Convention. In doing so they would

in no way injure the interests of their consumers and would render undoubted services to their Colonies and refiners, apart from any question of general equity, or of good relations between England and the other powers.

The English Government pretend to be acting in conformity with the principles of free trade, but in reality are encouraging protection and the bounties resulting from it. The Brussels Convention has made the first breach in the walls which protect Europe. This is encouraging for the future, for it shows that the industrial and agricultural protective system can be abolished without any real injury to industry or agriculture; always assuming that everyone acts loyally and in good faith. Alas, the English Government, who can claim the merit of having been the first to bring about this good result, are now occupied in destroying that which they themselves have built, and in postponing for an indefinite period the triumph of Free Trade, of which they pretend to be the champions.

SUGAR BEET GROWING IN ENGLAND.

House of Lords Debate.

On July 3rd last the Earl of Denbigh called attention in the House of Lords to the fact that the policy of the British Government with regard to the Brussels Convention had caused the abandonment of an important project for growing 2,000 acres of sugar beet in the neighbourhood of Sleaford, Lincolnshire, in which connection a factory was to have been erected employing 120 men in the winter months. He thought that those members of the Government who found themselves committed against the Convention were giving no thought or heed as to how their action in regard to it would affect the agricultural interests of the country. They steadily ignored every attempt that was made to call their attention to the practical side of the beet sugar industry. He had himself on several occasions drawn their attention to the question, but the Government had treated the matter with contempt and indifference as a scheme of "impracticable enthusiasts." He thought the real difficulty the supporters of the scheme had to contend with was the fact that the public as yet knew very little of the interests involved in the question. As a consequence the Government were taking advantage of it to use the Convention purely as a political weapon.

Lord Fitzmaurice, speaking for the Government, said that the Lords would all agree that this was an important question, but what separated the Opposition from the Government were questions of principle and belief. He declared that during the short time that the Government had been in office it had actively shown what it was disposed to do for the agricultural interest. Referring to the

Government's position with regard to the Convention, he admitted that the abolition of the penal clauses by themselves would doubtless have the effect of making it easier for bounty-fed sugars of non-convention countries to come into this country. But that was a different matter from the larger question of the introduction of cartel sugars. As to the broad lines of the policy of the Government, they were not ashamed to say that they were above all things a free trade Government. They were convinced that whatever small advantages might accrue locally by the development of such industries as beet sugar growing would be infinitesimal compared with the loss of those advantages which the absolute freedom of entry of sugar into this country would bring about.

THE IMPROVEMENT OF THE SUGAR CANE INDUSTRY IN INDIA.

At a meeting of the Board of Agriculture of India, at Cawnpore, last February, the subject of the Indian sugar industry came up for discussion, and we understand that a committee was formed to draw up a scheme for the improvement of the industry. The Committee's report has just been published in the *Proceedings of the Board of Agriculture in India*, and as it is of considerable interest we venture to reproduce it here:—

1. The committee considers that sugar cane experiments on the scale contemplated by the terms of reference should only be started in tracts where the crop is at present of *commercial* importance or likely to become so. In tracts where sugar cane is grown only for domestic consumption, the trials (if any) should be on a much more limited scale.

2. The information given in the provincial reports as to the increase or decrease of sugar cane cultivation in each province is not complete, but it does not tend to show that there has been any important change except in a few isolated cases. The fluctations in area, which sometimes extend over short periods of years, appear to be due mostly to seasonal variations in the rainfall, particularly at the sowing season, and to the economic condition of the people. Thus the decrease in recent years in the Bombay Presidency appears to be due to bad seasons, and the reduction in the resources of the cultivators owing to the effects of famines. In the United Provinces (which account for practically half of the total area under cane in India) the cultivation has been fairly constant, and as the result of a favourable sowing season this year's area is very nearly the highest on record. The Bengal statistics show a large reduction from 755,000 acres in 1890 to 423,500 acres in the present year, but these statistics have to be received with caution, while in recent years the reduced

prices of sugar and the profits on jute cultivation are believed to have resulted in a contraction of the cane area. The large reduction in the Central Provinces, from 96,000 acres in the early sixties to 18,000 acres last year, is believed to be largely due to the extension of railways; in early years the cultivators were obliged to grow home supplies, but they have been unable to compete with the more favourable cane tracts of the United Provinces and Bombay, and have substituted other more profitable crops such as cotton. Before undertaking any important scheme of sugar cane experiments in a tract, it is recommended that the past history of sugar cane cultivation should be thoroughly inquired into.

3. *The objects of a sugar cane experiment station* are some or all of the following:—

(*a*) The investigation of the manurial requirements of the cane, and the available supplies of manures.

(*b*) The testing of varieties with a view of introducing a better cane.

(*c*) The improvement of existing canes by chemical selection.

(*d*) Attempts to raise seedling canes.

(*e*) The methods for preventing the ravages of pests and diseases.

(*f*) Cultivation experiments (including methods and times of planting, supply of cane for sowing, distance apart of the canes, methods of after cultivation, mulching, trashing, irrigation, drainage, and the like).

(*g*) Improvements in the manufacture of the product.

4. In conducting the field experiments, the plots should be if possible $\frac{1}{5}$ of an acre or at the very least $\frac{1}{10}$ of an acre in area. They should be oblong in shape and laid out as long as practicable, at least 2×1. Oblong plots ensure greater uniformity in soil conditions and greater ease in cultivation. The soil of each experimental area should, in the first place, be carefully tested by growing a crop to determine the degree of uniformity. The number of sets in each plot of a series should be the same and should be examined for freedom from disease, and great care should be taken to replace vacancies. The irrigation water for each plot should be carefully measured.

5. To enable the experiments to be made year after year provision must be made for rotation. This requires that the total area available for experiments should be at least twice that under cane in any given year. To ensure accuracy it is desirable to duplicate all the plots.

6. *The area required.*

For one set of *manurial experiments* it is estimated that about 3·6 acres is required if $\frac{1}{10}$ acre plots are used. For any other series of experiments an equal area should be set aside.

In testing imported varieties it is essential that the canes be tried for a series of years and finally on a moderately large scale, say one acre plots, before being distributed. It is suggested that no cane be sent out before it has been under observation in the station for a sub-

stantial number of years. To test a reasonable number of canes in this way about 5 acres of land would be required provided the plots after the first selection are restricted to $\frac{1}{10}$ of an acre. Instead of the testing of imported varieties the area might be utilised for experiments on the improvement of existing varieties by chemical selection.

The *cultivation experiments* would require an area of about six acres. In addition at least 5 acres should be set aside to test any further questions which might arise after the main experiments have been started. The total area of the station should thus be about 25 acres, one half of which would be under canes in any given year.

7. *Equipment.*—As it is essential that there should be no delay in crushing the experimental canes as soon as they are ripe, a power mill is necessary capable of dealing with about 2½ to 3 tons of canes per hour or 30 tons per working day. It is desirable that the whole of the plots in any series should be, in general, crushed within a week. The estimated cost of this equipment is about Rs. 7,500 (including shed).

8. *Ripening of the Cane.*—In conducting field experiments with sugar cane it is essential to determine when the cane is ripe at its best. The only safe method is to analyse the cane as it approaches ripeness once a week or once a fortnight. The appearance of the cane is not a sufficient index to determine whether it is ripe. The analyses can be conducted by a reliable trained Indian assistant. When the plots are large, trial boilings can also be conducted in conjunction with the analytical work.

9. *The Determination of the Yield.*—As neither the weight of canes nor the amount of *gur* is a reliable index of the yield, it is necessary to weigh the canes, to crush them, and to determine amount of sucrose in the cane and that left in the bagasse. The results of an experiment should be expressed in tons of sucrose in the juice per acre and the purity of the juice should also be recorded. A calculation of the results from the weight of the canes and the analysis of a sample is not desirable. The determination recommended is the most reliable test, but, if desired, the juice can be made into *gur* and the weight stated, for the information of cultivators.

10. *Manufacture.*—The imports of all classes of sugar, which have increased from 168,000 tons in 1894-95 to 347,000 tons, amounting to 2½ lbs. per head of the population of India, show the great demand for sugar in India. The attached letter from the Bombay Chamber of Commerce gives some interesting information as to the class of import trade at that port.

The Committee recommends that a careful inquiry should be made into the actual efficiency and the losses that occur at the various stages of the indigenous processes for the manufacture of *gur* or *jaggery* with a view to ascertain the best methods of lessening such losses.

11. *Milling.*—The following information concerning milling tests was supplied. In the United Provinces with thin canes, the best of the iron mills in ordinary use gives about 65 per cent. of extraction, whilst the inferior mills give about 45 per cent. In Mysore with thick canes the local 3-roller iron vertical mill gives 67½ per cent. of extraction, whilst a small power mill gives 76 per cent.; these mills were working at their highest efficiency. In Bombay, the local Poona mill with thick canes gives an extraction of 68 to 72 per cent. The improvement of the local mills is, therefore, one of the most important branches in which advance seems possible.

12. *Receptacles for collecting juice.*—Experiments in Mysore show that losses from fermentation due to the use of dirty receptacles amount to about 10 per cent. of the sugar in the juice. The discarding of earthenware pots, and the use of iron or copper receptacles, combined with cleanliness would prevent a considerable proportion of this loss.

13. *Liming.*—In the United Provinces liming is not practised, *sajji* (carbonate of soda) being used, which results in great losses of sugar. In Mysore, experiments have shown that the average loss of sucrose from imperfect liming amounts to 18¼ per cent. A careful investigation should be made into the liming processes, in which attention should also be given to its effects on the colour and the keeping qualities of the *gur*.

14. *Methods of straining and skimming.*—Inquiry should be made into the possibility of improving the existing methods by the use of filter clothes and the like.

15. *Boiling.*—Inquiry should be made into the losses that occur through delay in boiling, charring, burning, and the like. The possibility of introducing boiling pans of improved shape should be considered.

16. *Indigenous Processes of Sugar-making.*—The committee recommends a careful investigation of indigenous processes of sugar-making with a view to improvement on the lines followed in the United Provinces. It also recommends an investigation of the Hadi processes to determine the actual losses that occur at each stage and the possibility of avoiding them. The Hadi equipment, consisting of three boiling plants, centrifugal and engine with boiler, costs about Rs. 4,650 (exclusive of mill, which may either be worked by engine power or by bullock), which deals with 40 maunds of *rab* a day giving 20 maunds of sugar (= 1½ acres of cane a day or 100 acres of cane in a season).

17. *Small Power Factory System.*—The type of equipment depends on the class of sugar to be produced; the production of *white* sugar postulates the use of vacuum pans, which involve a substantial area of cane (100 acres or more) for their efficient use, whilst sugar of a lower grade needs only open pans and steam boiling. The committee

considered the type of equipment usually employed on small factories in the West Indies for the production of "muscovado" sugar, consisting of a 3-roller mill, clarifier, settling tank, filter press, sulphur apparatus, open train of evaporators, pug-mill and centrifugal, engine and boiler. It is roughly estimated that a plant of this description, dealing with two tons of cane per hour in a working day of 12 hours or 1500 tons of cane over a working season of 63 days (= about 50 acres of cane in the Poona District or 100 acres of cane in the United Provinces), would cost about Rs. 20,000, or, including necessary buildings, &c., Rs. 25,000. This amounts to a heavy outlay per acre of cane, but from the information available it would seem that the losses avoided by using such a plant, including an estimated saving of 9 per cent. of juice in milling, 10 per cent. of sugar outturn from avoidance of inversion, and, allowing for loss on the molasses and for the cost of working, would apparently give a fair prospect for its introduction into suitable tracts, provided that local conditions are favourable. The committee recommends that, if further inquiries verify this forecast, such a small power factory might be tried as an experiment at a suitable sugar experiment station.

18. *Central Factory System.*—The information before the committee was not sufficient to enable them to state the conditions necessary to the successful working of a large central factory. It is recommended that these conditions should be ascertained, that departments of agriculture should make local inquiries as to the tracts where these conditions are most nearly approached, and publish the results for general information The causes of past failures of this system in certain cases should be inquired into.

The letter referred to above was as follows:—

The Chamber of Commerce,
Bombay, 13th February, 1907.

J. B. Knight, Esq., M.Sc., Professor of Agriculture, Poona.

Sir,

I am directed to acknowledge receipt of your letter of the 31st ultimo, and to submit the following information in reply to the queries contained therein :—

(1) The import trade in sugar is in a somewhat abnormal state at present, as contrary to what has been the case for several years past, imports of Continental beet sugar have lately fallen off to a very great extent. White Javas have come into favour and these are largely replacing beet sugars. A fair amount of White Java has recently been put through Bombay at about 9d. under the rate ruling at home for Austrian beet; and as the Bazaar difference between

Austrian and Javas is only one anna per cwt. in favour of Austrian, business in the latter description is impossible.

The demand of the native consumers largely influences this trade. Nowadays the better classes of natives prefer the white sugars to the usual locally produced "jaggery," or to the Brown Mauritius, and for such white sugars they have to look to the countries producing white qualities, such as Austria, Germany and Java. These white sugars, imported through Bombay, find their way to Guzerat Districts, viz., Surat, Ahmedabad, &c., and on the G. I. P. Ry. they go as far north as Delhi.

As to the chance of replacing imported sugars by sugars manufactured from superior plants in this country, this is a question my Committee are not prepared to give an opinion on, as it is one that would more appropriately be decided by an agricultural expert. However, allowing that conditions for growing canes are as favourable in India as they are in Mauritius and Java, the utilization of superior machinery for the manufacture of white sugars in this country, would, it is believed, prove a profitable investment. Such sugars when compared with Java and Mauritius sugars would have the advantage of saving the ocean freight (from 12 to 15 shillings per ton), as well as the 5% Imperial duty. There would also be the further advantage of cheap labour, compared with that of Austria and other Continental countries.

(2) The imports of foreign sugars into the Bombay Presidency (excluding Sind) during the past five years are herewith given on a separate sheet. (See Table below.)

(3) The restrictions placed on sugars favoured by bounties, whether direct or indirect, are believed not to have proved beneficial to India. The only countries that benefited by bounties were Mauritius and Java, and to a lesser degree, the United Kingdom through a few of her refiners. It is not thought that the restrictions on imported sugar had any appreciable effect on the refineries in this country, nor on its sugar cultivation. Broadly speaking, the countervailing duty of something over a rupee had practically no effect on imports of any sugar. An additional duty of about 3s. was subsequently imposed to meet the sugar refined under the Cartel system in Austria, and this had the effect of making the sugar in question too expensive as compared with cane sugar shipped from the United Kingdom, and some other beet sugars which replaced it.

Some further information on this subject will be found in the Report of the First Conference of Indian and Ceylon Chambers of Commerce, January, 1905, in pages 52 to 59.

I am, &c.,

(Sd.) J. B. LESLIE ROGERS,

Secretary.

SUGAR (REFINED).—THE FOLLOWING TABLE SHOWS THE QUANTITIES AND SOURCES OF SUPPLY OF THE IMPORTS OF THIS ARTICLE DURING THE PAST FIVE YEARS.

Whence Imported.	1901-02.		1902-03.		1903-04.		1904-05.		1905-06.	
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
United Kingdom.	1,840	23,756	75,106	736,530	63,546	660,373	1,613	24,281	108,955	1,048,144
Austria-Hungary.	555,648	6,033,859	353,227	3,503,044	112,786	1,100,139	411,440	4,553,164	517,149	4,801,082
Belgium	1,000	12,350	44,849	445,197	397	4,188	....	....	67,770	609,777
France	59	664	20	231	121	1,654	39,502	494,167	86,214	796,611
Germany	111,463	1,257,158	20,259	202,581	4,864	49,070	58,672	149,457	202,731	1,816,550
Holland	....	....	34,077	344,032	14,525	147,263	....	....	....	....
Mauritius	1,535,791	16,072,254	1,514,762	14,929,644	2,001,018	19,447,275	1,527,364	16,129,588	1,683,120	16,589,027
Reunion	....	....	....	....	3,641	36,415	20,974	231,088	35,183	342,133
Egypt	17,124	171,627	6,315	68,927	67,221	700,391	165,737	2,082,947	65,940	757,531
Hongkong	109,379	1,292,673	224,468	2,324,272	143,854	1,551,930	114,889	1,365,479	67,014	833,183
Java	....	....	50,512	478,838	156,065	1,491,732	254,106	2,712,347	217,617	2,184,104
Straits Settlements	....	1	52,550	490,143	3,273	33,035	73,198	781,040	8,158	86,280
Other places	5,902	69,498	1,126	10,763	87	1,175	122	1,899	438	9,024
Total	2,338,206	24,933,840	2,377,271	23,534,202	2,571,398	25,224,640	2,667,617	29,025,457	3,960,289	29,873,416
Re-Export	52,083	614,671	21,119	227,819	29,291	302,591	40,023	423,505	139,976	1,519,425
Exports in Coasting Trade	411,373	4,716,660	380,144	3,770,195	569,740	5,747,558	438,804	4,784,436	605,150	6,474,027

FIGURES RELATING TO NINETY-SIX JAVA SUGAR MILLS DURING THE SEASON 1906.

	Sugar.					Maceration water on 100 parts of normal Juice.
	Per cent. Sucrose in the Cane.	Per cent. Sucrose indicated in the Juice on 100 Cane.	Available Sugar (Muscovado) $1{\cdot}4 - \frac{40}{\text{Quot.}}$	Juice extracted on 100 parts of Juice.	Per cent. Fibre in the Cane.	
Highest ..	14·58	13·53	12·62	92·9	14·23	23·12
Lowest ..	9·94	8·76	8·02	86·2	9·39	6·84
Average ..	12·38	11·25	10·33	90·8	11·77	14·00

	Bagasse.			Filterpress Cakes.	
	Sucrose.	Moisture.	Sucrose lost on 100 parts of Cane.	Sucrose.	Sucrose lost on 100 parts of Cane.
Highest ..	6·34	53·24	1·82	10·93	0·32
Lowest ..	3·71	40·92	0·86	1·15	0·04
Average ..	4·48	47·11	1·11	7·47	0·09

	First Mill Juice.			Last Mill Juice.	
	Brix.	Sucrose.	Quotient.	Brix.	Quotient.
Highest ..	19·81	18·6	89·41	12·66	85·2
Lowest ..	15·30	12·13	78·97	4·84	63·01
Average ..	17·72	15·11	84·78	7·66	78·23

	Mixed Juice			Quotient Clarified Juice.	Syrup.	
	Brix.	Sucrose.	Quotient.		Brix.	Quotient.
Highest ..	17·60	14·80	87·83	90·65	62·60	90·00
Lowest ..	13·30	10·41	75·51	79·6	41·53	79·59
Average ..	15·50	13·05	82·91	84·89	53·58	15·26

	Masse-cuite.		Quotient of First Molasses.	Sugar.		
				Polarization of		
	Brix.	Quotient.		Head Sugar.	Muscovado.	Second Boilings.
Highest ..	98·10	91·63	76·59	99·63	98·6	98·99
Lowest ..	88·82	57·60	38·1	97·20	96·3	82·36
Average ..	94·82	71·75	50·46	98·71	97·37	92·90

	Sugar (continued).						Quotient of Exhausted Molasses.
	Head Sugar.	Musco-vado.	Second Boilings.	Black Stroop.	Total Sugar (Black Stroop 2 : 1)	Sucrose.	
	Turned out on 100 Cane.						
Highest ..	10·91	11·98	10·20	1·33	12·47	12·31	40·80
Lowest ..	0·01	0·37	0·01	0·02	7·55	8·26	28·9
Average ..	4·61	7·04	1·43	0·55	10·65	10·01	34·45

SOME CONSIDERATIONS GOVERNING THE DESIGN OF MULTIPLE EFFECTS.*

The multiple effect evaporator of the present form is the result of a long and gradual development. It is well known that for a long time, sugar was made in what is called the "open kettle process." In 1834, Pecquer made the beginning which resulted in the multiple use of steam. Pecquer's machine, however, differed from the modern machine in that fire was applied directly to the lower vessel or boiler, the vapour passed from the first vessel up to the second, from the second to the third, &c., the last vessel being open to the atmosphere. It was evidently necessary that the first vessel in this arrangement should have a relatively high pressure in order that the pressure might diminish from vessel to vessel with atmospheric pressure as the minimum. This resulted unsatisfactorily, as the temperatures were too high for sugar work. About the year 1800 Howard invented the vacuum pan which was successfully used with the open kettle evaporation. It remained for Rillieux to combine the principles of Howard's and Pacquer's apparatus in the construction of a multiple effect, the first of which was made in 1852 and which was of the horizontal type.

Pans with the naked fire required about ten pounds of coal to produce one pound of sugar. Howard's vacuum pan reduced the coal consumption about 37½ per cent., and the Rillieux apparatus reduced it about 60 per cent. more. The multiple effect has been improved greatly since Rillieux's first one, and improvement is still being made.

Experience has demonstrated that the proportions and efficient operation of multiple effects are proportional to: (1) the speed of circulation of the liquid on the heating surface; (2) inversely as the height or pressure of the liquid on the heating surface; (3) the speed of circulation of the steam or vapour on the heating surface; (4) the rapidity and completeness of the removal of the condensed water from the heating surface; (5) the completeness of the vacuum in the evaporating chamber; (6) the conductivity of the metal used for the heating surface and its freedom from scale; (7) inversely as the density of the liquid and (8) the difference between the temperature of the heating medium on one side of the heating surface and that of the juice on the other side. In addition to these there are certain losses which must be guarded against, principal of which are entrainment and radiation. It is therefore the office of the designer to take these considerations strictly into account in proportioning his machine. A careful study of the same will also enable the operator to do better work. The writer has therefore thought that a review of the theories

*A paper by E. W. Kerr, Professor of Mechanical Engineering, Louisiana State University, read before the Louisiana Sugar Planters' Association, June 13th, 1907.

as well as the past developments might be more or less profitable to the operator as well as the designer.

Circulation.—Good circulation of the juice on the heating surface promotes the transmission of the heat from the steam to the liquid and, to a certain extent, the prevention of scale by the washing action. It is clear that the transmission of heat depends mainly upon the difference of temperature. The principal value of the rapid circulation is in keeping this difference as large as possible. Let the two figures * represent two bodies of water subjected to the heat of a fire underneath. That at the left is arranged so that a very thin sheet of water flows over it with considerable velocity. That at the right contains water without motion. Both of them have the same thickness of metal between the fire and the water. Experiment will show that the first will transmit something like 600 to 800 B.T.U. per degree difference of temperature through one square foot of surface in one hour, while the other will transmit only 12 to 15. This shows that the thickness and material of the heating surface have relatively little to do with the rapidity of heat transmission, and that the velocity of movement affects it greatly. It is therefore evident that anything that will improve the circulation is worthy of attention.

Juice circulation is naturally better in the vertical or standard effect than in the horizontal effect, because the juice is on the inside of the tubes and there is a defined path of motion. The juice rises through the tubes by convection, and then returns downward through a large central tube, which is usually called the downtake, the area of which should be equal to the combined area of all the tubes for the best circulation. Sometimes this return is made to take place through an annular space between the outside tubes and the shell of the effect.

It is a well-known fact that one of the principal advantages of the water tube boiler is in its superior circulation of water as compared with the older type of fire tube boiler. In this respect the vertical or standard effect is analogous to the water tube boiler and the horizontal effect to the fire tube boiler in which there is no defined path of circulation. The efficient circulation of the water tube boiler is usually obtained by means of inclined tubes, though the boiler as a whole may be and generally is horizontal. Since water rises when heated the inclined tube has a movement of water from the lower to the higher end, and by establishing another connection between the ends of the tube a circuit is completed. In the fire tube boiler, which has water on the outside of the tubes, the circulation is between the tubes and between the tubes and the shell. The tubes are usually placed in vertical rows and not too close together so as to facilitate circulation. The same conditions prevail in the horizontal effect.

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* This paper was evidently illustrated by lime-light views, which, however, are not reproduced in the printed versions.

The speed of circulation may be increased by making the tubes smaller, as in this way the volume of the tubes decreases more than does the heating surface, making a greater velocity necessary in order to get a given quantity of juice through. The same effect may be obtained by suspending wood or iron rods in the tubes. Another form of effect differs from the standard effect only in having it tilted through a small angle, the object of which is to facilitate the movement of the juice over the top tube plate from the tops of the tubes to the downtake. In the Chapman evaporator the cylindrical downtake is replaced by a cone with the small end down, the object of the cone shape being to accommodate the changing volume of the vapour and juice on the way downward. The different vessels are connected by siphons in such a way as to make the entire circulation practically automatic. The next is the Witcowitz evaporator, which is sometimes used also as a heater. It has a steel body and the juice circulates through tubes, the steam being on the outside. This arrangement is designed to give a very rapid circulation. The Express system comes next; the juice circulates through the tubes and the steam enters into the belt. In an effect of this system there is another calandria above the one shown, in a position the same as though the lower one were revolved through an angle of 180° about an horizontal axis through the centre of the effect. This arrangement may also be applied to a standard effect below the existing calandria. This, it will be seen, will also facilitate the removal of the condensed water from the lower tube plates. An effect following more closely the design of a water tube boiler is shown in the illustration. The juice is on the inside of the tubes, and the design, which is of recent origin, is expected to give excellent circulation which will evidently be in a clockwise direction.

The discussion of circulation would not be complete without mention of the film type of evaporators, of which the Lillie, the Yaryan, and the Kestner are examples, in each of which there is rapid motion of the liquid. In the first two, the circulation is forced by means of pumps. These, however, will be described more in detail under another head. The Kestner has no circuit, but the very small disengagement area causes an extremely violent boiling which produces a rapid upward movement.

Juice Level.—It is a well known fact that the boiling temperature of any liquid varies with the pressure under which it exists; for example, at 100 lbs. pressure the boiling temperature is about 337° F., at 50 lbs. pressure 298° F., and at 29 ins. of vacuum about 70° F. To illustrate the effect of a high juice level, consider the second vessel of a triple in which we will assume a vacuum of 16 inches of mercury which corresponds to an absolute pressure of 14 inches of mercury and a temperature of 176·4° F. Assume also that the total height of the juice is 6 feet. It is evident that a particle of juice at the very

bottom will have to evaporate against the vapour pressure plus that due to the 6 feet of water above it, and that the average for the entire body of water would be the vapour pressure plus that due to the average head of water, which is 3 feet. It is easy to determine by a calculation that the temperature of boiling in the effect is increased more than 3° by water-head. A similar calculation for the third effect in which the liquid has a greater density shows a temperature increase of about 5° above that due to the vapour pressure alone.

This is evidence that the efficiency of the heating surface may be increased by making the juice height as small as possible, for it takes heat from the steam to supply the increase in temperature. Many different designs have been brought out with this purpose in view. The horizontal effect in which the juice height is generally about 24 inches represents the best that has been obtained along this line, while on the other hand the vertical effect with its tubes 3½ to 4½ feet in length results in considerable loss. In some cases this loss has been partly remedied by keeping the juice level below the upper tube plate rather than completely submerging it as was formerly done. It is found that by this arrangement the tubes may be long, thus maintaining the required amount of heating surface, and the juice being projected out of the tubes by the escaping bubbles keeps that part of the tube above the juice level covered. In this manner the entire surface of the tube acts as heating surface, yet with a reduced height of juice. The level of the juice in this plan of working is determined by having the juice always spurting from each of the tubes. On account of the increased density toward the last effect the boiling is more violent, therefore the level of the juice may be lower in the last effect. With the horizontal effect it is possible to get a required amount of heating surface with a small juice head. This is one of the principal points of superiority of this machine as compared with the vertical. In the film types this loss is practically nothing, and especially so in the Lillie and Yaryan types. In the Kestner there is a very high projection of the juice, but the level is very low. The principle is similar to that already explained whereby the juice level in the standard effects is kept lower than the tops of the tubes. Even though the tubes are very high, and the juice is made to travel up their entire length, it is so thoroughly mixed and emulsioned with the vapour that there is no increased pressure due to the head of juice. In the Yaryan type the evaporation takes place in partially filled tubes. This means that the depth of the juice is never more than the diameter of the tubes and usually less. This machine, however, has been found to give trouble in the regulation of its juice feed in operation.

(To be continued.)

FERTILIZERS.*

By D. W. May, Agricultural Experiment Station, Porto Rico.

Mr. D. W. May, the Special Agent in charge of the Porto Rico Experiment Station, gives in one of the Official Circulars some interesting and useful details on the question of fertilizers. Although his information is primarily intended for Porto Ricans, yet much of it is worthy of study by planters in other parts of the world, so we venture to reproduce here such portions of it as seem to us particularly suitable.

Introduction.

The base of all agricultural practise is the soil; upon the capacity and proper management of soils all success in agriculture primarily depends. The plant secures from the soil and the air some fifteen different elements—from these it adds to its growth. By a chemical analysis we find what different elements plants contain and the amounts, as lime, iron, nitrogen, phosphorus, &c. From studies made during the last one hundred years it has been found that of the different substances going into the composition of plants, the three which are most likely to be deficient in average soils are nitrogen, phosphorus, and potash. Soils may be benefited by the addition of other elements, as lime, but it is believed to be due more to their physical action than the fact that the plant actually needs more of such elements than are already available in the soil.

In general a fertilizer may be said to be anything that improves the capacity of the soil to grow plants. A fertilizer may do this by, first, adding to the soil an element that is lacking and that is needed by the plants; or second, by improving the physical condition of the soil so that plants may take therefrom certain elements that are thereby rendered available. Moreover, certain fertilizers contain small organisms known as bacteria, which set free in the soil elements needed by the plant. It is largely for this reason and because of the decaying vegetable matter in it which improves the physical condition of the soil that manure makes one of the best fertilizers.

Porto Rico is one of the older settled portions of the Western Hemisphere; moreover, it has sustained for many years a very dense population. The island has produced many crops that have drawn heavily upon the soil, so that now agriculture presents many of the problems of handling an abandoned farm. The great mistake made in agricultural practise in Porto Rico has been in the continued cropping of soils without adding anything thereto.

A field of the experiment station will exemplify the usual

* It may be as well to observe that the word "Fertilizers" is used in the United States to describe "Manures" in general, and not only the special class of manure which the word implies in England.

practise here. This piece of land has been cropped for perhaps two hundred years; cane has been taken from this field as long as it would produce cane and then it has been allowed to grow up in malojillo grass and this crop cut and sold off the place in the neighbouring town. A former owner told the writer that during his occupancy sixteen crops of cane were taken from this field one year after another. Considering such treatment, is it any wonder that the fields of Porto Rico are depleted and a great many of them abandoned?

What then is the first duty of the agriculturist in Porto Rico—indeed, what is the prime necessity? It is to bring back to the land some of the old time fertility which gave to the island the name Porto Rico—rich port.

The elements of plant food most likely to be needed in soils are nitrogen, phosphorus, and potash. Very poor soils, like most of those found in Porto Rico, need all three of these, and in many instances lime also. Therefore, in improving the soil we must seek out and apply especially all the nitrogen, phosphorus, and potash that we can find. Upon the application of these to our fields depends the future prosperity of the island. Let us then look to the sources from which we can obtain these elements of fertility.

Natural Manures.

The first of these to command our attention is the supply of manure. This will in nowise meet the requirements, yet the amount available is now largely wasted. Take the city of Mayaguez as an example. Manure is given to any one that will haul it, and yet large amounts are allowed to be leached by the rain and dissipated by the sun in piles about the stables, proving a nuisance to the town and of no benefit to the country. In sections where agriculture is more advanced such manures sell readily, the buyer not only removing it from the stables and lots, but paying a substantial price for it. Happily its value is becoming realized and some planters are hauling it, and even shipping it long distances along the coast, from towns to their plantations. This material proves of great benefit to our fields, not only from the fact that it yields nitrogen, phosphorous, and potash, but also humus, which greatly improves the physical condition of the soil, rendering it more porous, permitting plants to extend their roots more readily and to take up more plant food. The manure produced by horses has been estimated to be worth $27 per head for one year, for cattle $19, and for hogs $12. This value, of course, depends upon the character of the feed consumed by the animals. Its value also largely depends upon the method by which it is handled. If convenient to do so, manure should be immediately hauled and spread upon the land and, better, ploughed under. If this is not possible, it should be stored in pits and kept reasonably moist until well rotted. The value of manure, estimated on the amount of nitrogen, phosphorus, and potash it contains, will vary from $2·50

to $4 per ton. This will give some idea of the money thrown away in the ordinary wasteful method of handling manure in Porto Rico.

A ton of mixed pasture grasses contains 18 pounds of nitrogen, 4·6 pounds phosphoric acid, and 15 pounds potash. The value of these elements as we purchase them back, estimating nitrogen at 15 cents per pound, phosphoric acid at 5 cents, and potash at 5 cents, would be as follows per ton :—

Fertilizing value of grass per ton.

Nitrogen	$2·70
Phosphoric acid	·23
Potash	·75
Total	$3·68

Another valuable substance available to Porto Rican planters for fertilizing the soil is tobacco stems and waste from the cigar factories. This substance is particularly rich in potash. Tobacco stalks contain 3·7 per cent. nitrogen, 5 per cent. potash, and 0·65 per cent. phosphoric acid.* The stems contains less nitrogen and more potash. Such refuse at fertilizer prices is worth about $15 per ton. Besides improving the physical texture of the soils, tobacco waste has a value as an insecticide, having a tendency to keep insects out of the soil. All tobacco stems and waste should be carefully preserved and used for improving our soils. At present these materials can be secured at very low prices and the enterprising planter will secure all that it is possible for him to obtain at fair prices.

Lime is found in varying amounts in all plants and is necessary to their growth. It is found in all soils and usually in amounts sufficient for the direct needs of the plant. It is, however, often needed on soils that have become acid, for the purpose of rendering them sweet and improving their physical condition. It not only renders them more friable, especially clay soils, but it apparently has the effect of rendering certain plant foods more available. The form of lime usually employed is burnt lime, known as quicklime. The price in the island varies with localities and ranges from $5 to $7 per ton.

There is in many sections a soft limestone found, more especially in the first range of hills from the seacoast. These deposits are probably of sea formation, and the lime as it comes out of the earth is soft and may be cut with a spade. From analyses the station had made these limes run over 50 per cent. calcium oxide (CaO). From preliminary experiments made with this material it seems that it is a valuable substance to use for liming soils. Where it is convenient planters are recommended to try using it on land in comparison with other portions where it has not been applied. In this way its value can be very quickly determined.

* U. S. Dept. Agr., Office of Experiment Stations Bul. 15, p. 408.

In many parts of the island caves are found containing deposits of bat guano. Many of these deposits are quite valuable, being especially rich in phosphorus. Wherever these guanos can be obtained planters are advised to try them, starting with small amounts and comparing the results with crops where none has been applied.

Ashes, especially the unleached hardwood ashes, are an important source of potash, the latter holding over 5 per cent. of this element and containing some phosphorus. Where ashes are old and have been leached by the rains they are of little value, but fresh wood ashes should be applied to the land immediately after burning, and from them good results may be expected.

There are several other sources from which small amounts of manurial substances may be obtained on the farm. It is a good practice to have a pit or protected place where refuse from various sources may be dumped. Such a place is known as a compost heap and may contain residues of different plants, ashes from the kitchen, and waste materials that usually accumulate about a house. It is well to add lime to these materials, as it increases the value and induces decay.

Commercial Fertilizers.

After utilizing all the natural resources from which we may obtain the fertilizing elements it is necessary and advisable that Porto Rico buy commercial manures. The success of agriculture in the island undoubtedly rests upon the proper employment of fertilizers, and as we are only beginning to use them in any amount it is well that certain principles underlying their purchase and use be set forth. While success will depend upon the proper fertilization of our soils, at the same time a great deal of money can be spent on artificial manures that will not yield an adequate return. The planter should learn first of all and keep in mind the fact that in purchasing fertilizers he is not paying so much per ton, but so much per pound for the nitrogen, phosphorus, and potash contained therein. This is well recognised in countries where fertilizers have been used for some time and no consideration is had for the other portions of the fertilizer, or of the fillers, as they are called. It has been sought to reckon a price for the three elements, at so much per pound, and the value of a ton of fertilizer depends upon the number of pounds multiplied by the price per pound. The prices of nitrogen, phosphorus, and potash vary, as do other marketable products, depending upon the factor of supply and demand. At present nitrogen is worth in the neighbourhood of 16 cents, and phosphorus and potash 6 cents each per pound. A fertilizer containing all three of these elements is called a complete fertilizer.

Nitrogen.

Of the three elements that form the basis of value for a fertilizer nitrogen is the most expensive. This one element is represented by the symbol N. One part of nitrogen and three parts of hydrogen

make ammonia. This chemical combination is of value simply for the nitrogen it contains. The greatest source of nitrogen at the present time is the nitrate deposits of Chile and Peru. As this district receives no rain the nitrogen is not washed out as it is in other countries. The amounts of this material mined and shipped are enormous, and it is probable that in the course of a few decades the supply will be exhausted. Besides being used for a fertilizer this nitrate is also extensively used in the manufacture of gunpowder and for other purposes.

The air consists of a mixture of four parts of nitrogen to one part of oxygen. This would apparently indicate that plants do not need nitrogen in the soil, but it is a fact that with few exceptions plants are not able to secure nitrogen from the air. It has long been known that certain plants belonging to the family known as legumes enrich the soil upon which they grow. In this family belong peas, beans, clovers, and a number of trees, as the guama, flomboyan, &c. As many of these leguminous plants will grow in Porto Rico, and at any season of the year, it is not a wise policy to buy nitrogen for slow-growing, and especially the less profitable crops, when it can be so easily produced. It is only in the case where very profitable crops are desired quickly that any amount of this element should be purchased. In our fields nitrogen can be produced with beans especially. These can be grown in the rows or they can be grown as separate crops when the other crops do not cover the ground.

It is known that leguminous crops are able to store nitrogen in the soil by means of bacteria, small organisms that grow in nodules on the roots of these plants. It has been found that leguminous plants without these nodules do not secure the nitrogen from the air, while on the contrary those that do have nodules are able to secure it from this source. It is sometimes found that a legume new to a certain section will not store nitrogen because of the absence of the nodule-forming bacteria. In such cases it is therefore necessary to inoculate the soil with this bacteria. These inoculating organisms are found in soils were a certain leguminous crop has been grown for some time, and a new field planted to legumes may be inoculated by scattering a small amount of soil taken from a field in which that same legume has been growing and producing nodules. The seeds may also be inoculated before planting by sprinkling them with a thin watery solution of soil from an inoculated field.

Nitrogen is a stimulating manure and is best applied at the beginning of a crop or before. If it is in organic form it should be allowed time to rot for ferment, for only then is it available to the plant. When it has been produced by leguminous plants, like beans, it should be ploughed under and allowed some time to decay before the new crop is planted. It will start crops growing very quickly, but it should usually not be applied during the fruiting season, as

there is a tendency to induce further growth and not fruit. Applied late on cane fields it has a tendency to produce a large immature cane with a low sugar content.

PHOSPHORUS.

From studies made by the various experiment stations, phosphorus is the element that is most generally needed on our soils. This element is said to be the backbone of American agriculture. It is this element which limits the capacity of the larger areas cultivated within the bounds of the United States. We obtain phosphorus from by-products of several lines of manufacture. One of the greatest sources of phosphorus is bone. This material is gathered up about the country or it is secured from the packing houses where large numbers of animals are annually slaughtered for food. We also obtain phosphorus from basic slag, a by-product of the iron mills rich in phosphorus. This material is finely ground and added to the soil. These by-products provide only a small part of the needs of our soils for phosphorus. The phosphate mines in South Carolina, Florida, and Tennessee produce the largest amount of phosphorus that is now used. These mines were once thought to be inexhaustible, but at the present rate of removal they will be exhausted within a century. At the present time 1,500,000 tons of phosphate rock are removed annually. Of this the larger part is now exported. To render it more readily available phosphate rock is treated with sulphuric acid. This enables plants to take it up more readily, but from recent experiments it is doubtful if this is profitable except when the phosphorus is needed immediately. Wherever phosphates are finely ground, they are soon assimilated by the plants, and it is far more economical to buy the finely ground phosphate rather than the acid phosphate.

Before buying any large amount of phosphorus it is advisable to first use the supplies available at hand. Besides the manures and waste products, as tobacco stems, there are many large deposits of guanos found in the caves of the island, which are often very rich in phosphorus. These may be applied as they are dug out of the cave and do not need to be treated with sulphuric acid. Wherever these deposits are available, it is advisable that an analysis be made and that they be used wherever their transportation will justify. Phosphorus is needed during the entire life of the plant, and as it is not volatile in the air and is not readily washed out of the soil, it can be applied in larger amounts than nitrogen with little danger of loss.

(To be continued.)

The latest New Zealand Budget accords free entry into that colony of cotton piece goods, sugar, and currants.

THE DENUNCIATION OF THE BRUSSELS CONVENTION AND ITS INFLUENCE ON THE BRITISH SUGAR INDUSTRY.

By Sigmund Stein, Sugar Expert, Liverpool.

The Brussels Convention was largely the work of Mr. Joseph Chamberlain. When he was Minister for the Colonies he determined to help the sugar industry in the West Indian Colonies, and for that purpose endeavoured to put an end to the Continental sugar bounties and the sugar cartels. He succeeded through the power of his convictions and the Brussels Convention was concluded on 5th March, 1902.

This Convention brought much good to the world's sugar industry in general and to the West Indian Colonies and the British sugar refining industry in particular. It produced free trade in sugar unrestricted by bounties and Continental cartels.

The chief obstacle to the abolition of bounties on the Continent was the obstacle which also crops up in connection with proposals for disarmament. No one country would commence to dispense with them and no State dared to take the first step.

Yet the bounties would have ceased in course of time even without the Convention, and without the influence of Mr. Chamberlain they would have slowly disappeared. The Continental sugar countries could not afford to give bounties for ever at the expense of their taxpayers, simply and solely to create an artificial sugar market. Their increasing financial difficulties would have gone far to induce them to abandon their burden. England, however, made a definite end of bounties and cartels, because she fixed the date of their abolition.

As soon as the Brussels Convention was signed, an outcry was raised in certain quarters in England. The Convention was described as "a working model of protection." The makers of jams, biscuits, mineral waters, and confectionery united and tried to get public opinion on to their side as well as the then parliamentary Opposition, alleging that there would be a famine in sugar and prices would go up by leaps and bounds.

Unfortunately, there came the bad sugar crop of the year 1905. The deficit in the world's sugar production, through the failure of the crop, was variously accounted for; but this deficit fully explained the rise of 100% in the price of sugar on the world's market.

The instigators of the Convention, the Unionist party, had subsequently to make room for a Liberal Government. With the fall of Mr. Chamberlain and his Government the fate of the Convention seemed sealed. The former parliamentary Opposition, which now came in office, included in its unofficial programme an intention to

abolish the Brussels Convention. They calculated that the Convention during its existence had cost the ratepayers of the United Kingdom not less than £25,000,000, that it had brought little or no advantage to the West Indian Colonies and the British refiners, and, finally, that the forty-two millions of inhabitants of the United Kingdom had had to pay more for their sugar. And all this apart from the great damage done to the sugar-using industries.

The question of the Convention came up for discussion in Parliament from time to time, as the belief was prevalent that the Government contemplated tampering with the Convention, but the latter would not openly and directly declare their real intentions till the 6th June, 1907, when Sir Edward Grey stated, in the House of Commons, that it was inconsistent with the declared policy of the Government and incompatible with the interests of the British consumers and sugar using manufacturers to continue to be a party to the Convention.

The fetish of Free Trade and the sugar using industries formed the two cardinal considerations that led to the Government's decision. Simply and solely owing to their strange fiscal orthodoxy, without the slightest consideration of the grave consequences, and without any thorough investigation into the reasons for concluding this Convention, their mind has apparently been made up.

Sir Edward Grey declared further:—"The Government does not desire a revival of sugar bounties nor of sugar trusts or kartels." But in the same breath the Government declares "that it will be impossible to continue to penalize sugars which are bounty-fed."

There does not seem to be much logic in this Note of the Government. On one hand England does not desire a revival of bounties, yet on the other hand, if such bounties are given, England will not move one single step to fight them.

At the same time the English Government declare that they would be willing to remain a party to the Convention, subject to their not being compelled to penalize bounty-fed sugars.

If one considers that the Convention was concluded between the sugar-producing countries on the one part, and England, as the sugar-consuming country, on the other part to obtain a guarantee that bounty-fed sugar should be excluded from the English market, and that all sugars which were not bounty-fed should be treated equally on entering British ports, one can see that the other contracting parties cannot and will not accede to England's demand.

If England insists in future in treating bounty-fed sugars equally with non-bounty-fed, the whole idea and purpose of the Convention would be undermined. The Continental countries will not desire to have England as a member of the Convention under the new conditions.

It would matter very little if one of the sugar-producing countries were to denounce the Convention, but England, the sugar-consuming country *par excellence*, cannot be ignored.

England wishes by her action to have a certain freedom, to do what she likes; and yet thinks the Continental sugar-producing countries should continue to labour under the same restrictions to which so far they have been bound by the Convention.

Such an agreement, giving one party all the privileges and the other all the burden, is an outrage on common and State law. We may, therefore, be sure the Continental countries will not agree to this handcuffing process, by which England would enjoy her freedom to the full. They will, however, defend themselves against this "splendid isolation" of their neighbours. They will not grant sugar bounties in the future, but will devote a great deal more attention to their home consumption. The States concerned will unite and come to some agreement to protect themselves on the English market.

The latter is the world's sugar "Clearing House" and is indispensable to the Continental sugar-producing countries, because England takes the surplus of the European sugar production.

The sugar import duties in the different countries will be raised from the Continental 6 frcs. per 100 kilos., and the profit derived from the sale on the home market will be the weapon with which those countries will defend their position on the English market. The same state of affairs as existed in ante-Convention times will re-occur save that sugar bounties will be absent. The Continental sugar countries will not count England any more as a party to their sugar policy and will act solely in their own interests.

It is very difficult to understand the intentions of the Government, but perhaps it may be permissible to advance the following suppositions:—

1. Will the Government perhaps recoup the West Indian Colonies for their loss in another way? Sir Edward Grey declared: "There is no desire or intention on the part of the Government that any bounties on the production or exportation of sugar shall be given in the United Kingdom or in the sugar-exporting Crown Colonies." In this case it would be very difficult to say how such aid could be given.

2. Perhaps the Government's action is purely a political move to secure public opinion on its side in the persons of the English sugar consumers and the English sugar-using industries.

3. Is it an act to propitiate Russia? The latter has penalised Indian and Ceylon tea as a retaliation on England's penalizing Russian sugar.

4. Is it in order to show off better and more distinctly the "liberal" and "free trade" principles and to break with everything which the late Unionist Government created?

It is strange if one considers and compares the following statements:—

1. Joseph Chamberlain declared himself an antagonist of bounties

and sugar cartels, and the Government of which he was a member induced the Continental countries to agree to the Brussels Convention.

2. Gladstone declared that "no consumer has the right to demand a commodity under the price of production, especially when the price is made low by artificial means."

3. Sir H. Campbell-Bannerman declared at the Colonial Conference that England does not intend to introduce preferential duties, that it will not give preference to sugar coming from the Colonies, and that England wishes to obtain her sugar from whatever source she pleases, whether it is bounty-fed or not.

From the following three countries bounty-fed sugars could be imported: Russia, Argentina, Spain.

(a) Russian Sugar.

Russia produced last campaign 1,450,000 tons of beet sugar. Her sugar production can be greatly augmented, but not all at once, or to such an extent that it could unsettle the world's sugar market.

Difficulties with agricultural and factory labour, financial embarrassments, and the very small yield of beetroots per acre will always be an obstacle to Russian sugar cornering the markets. It must not be forgotten that what Russian sugar is exported is only of a low quality, solely applicable for manufacturing purposes.

On the other hand the consumption of sugar in Russia itself increases from year to year. And as Russian sugar, which would come to England, would open the market in Asia for other producing countries, there would only be a diversion of sugar supply, so that the English sugar consumers and sugar-using industries would not obtain their sugar very much cheaper than they do at present.

If, however, the sugar industry of Russia unexpectedly attains to an extent similar to that of Germany, there will be a sugar crisis, against which the Continental sugar countries will have to fight with weapons already known in the history of sugar. Cheap prices for Russian sugar would certainly depress the market and bring on a stagnation.

(b) Sugar from Argentina.

From Argentina as well very little sugar can be expected, especially if the present sugar crisis out there should continue. The Argentine sugar consumption already exceeds the production, and facilities have been lately granted by the Argentine Government for the import of sugar.

	Tons.
Argentina's sugar production was—1905	137,090
,, ,, ,, ,, 1906	118,817
Stocks of sugar in Argentina, 1st January, 1906 ..	11,959
,, ,, ,, ,, 1907....	3,779

Sugar Production of Argentina.

	Tons.		Tons.
1898	79,431	1903	141,284
1899	103,333	1904	130,092
1900	115,934	1905	137,090
1901	165,314	1906	118,817
1902	126,440	1907	125,000

(c) Spain.

Spain has only a sugar production of about 100,000 tons, but her sugar industry is well able to expand, and bounty-fed sugar could be brought to England in appreciable quantities.

West Indies.

The cane sugar production of the West Indies, including British Guiana, is as follows:—

	Tons.		Tons.
1900	237,800	1903	290,250
1901	283,950	1904	263,450
1902	301,550	1905	255,650

Of this production there was exported to the United Kingdom in—

	Tons.		Tons.
1900	42,750	1903	42,100
1901	42,250	1904	58,100
1902	52,050	1905	61,250

Influence of the Denunciation of the Brussels Convention on the English Market.

1. *To the British sugar refining industry.*—The small advantages which the English sugar refiners derived from the Convention will disappear again. The same desperate state of affairs for them will prevail as existed before the Convention came in force. Only refineries which work specialities, that are not imported from the Continent and for which they can receive special prices, will survive; the others will succumb. For ordinary refined goods English refineries will not be able to compete against Continental offers.

Continental sugar refiners will unite, will create a strong protected market at home, and will use the profit so derived to fight the English sugar refiners in their home market. Any export of British refined sugar will be an impossibility.

2. *To the English beet sugar industry.*—Such an industry can easily be started in this country if, after the withdrawal of England from the Brussels Convention, the price of sugar on the world's market were governed by the cost of production. In any case, no sugar bounties will ever see daylight again. One enemy, however, lies on the horizon, and this is the system of cartels. Such a cartel business would seriously endanger any English

beet sugar industry. As a consequence of the declaration of Sir Edward Grey in the House of Commons, 6th June, 1907, several schemes which have been drawn up for the erection of beet sugar factories have been abandoned.

As I mentioned in previous papers, we have many advantages in this country over foreign beet sugar. But it is a matter of calculation how far such advantages will counterbalance any drawback to which such an English industry would be liable from foreign cartels.

3. *To the West Indian Colonies.*—Should the Government, after it has denounced the Brussels Convention, have no intention of helping the West Indian Colonies in one way or other to protect them against bounty-fed sugar and cartels, the Colonial sugar industry will be swept away. If one considers that the great percentage of sugar produced in the West Indies is made according to methods which are not now in fashion in modern sugar practice, one can easily see that the West Indies will not be able to compete any more.

But not in vain, let us hope, have petitions been sent from the Colonies to our home Government to get them to reconsider their decision towards the Brussels Convention.

It is just ten years since the Royal Commission investigated the state of the West Indian sugar industry, and after the denunciation of the Convention another Royal Commission will have to sit and consider how the West Indian Colonies can be helped in view of the ruin of their ancient sugar industry.

The enemies of the Convention will have in the near future plenty of time to consider the advantages and disadvantages of the Convention. But it will be too late then, for meanwhile the West Indians will have lost their sugar industry, and England her sugar refining trade.

THE SUGAR INDUSTRY IN RUSSIA.

(*British Consular Report.*)

The British Vice-Consul at Kieff contributes the following information relating to the Russian sugar industry:—

The campaign of 1906-07 with 278 factories in operation is officially stated as having produced 1,286,456 tons of sugar, the largest quantity ever produced in Russia, and no less than 410,739 tons in excess of the production from the campaign of 1905-06.

The stock of sugar on hand from the previous campaign is given as being 100,386 tons, made up of 64,335 tons of the inviolable reserve, 10,079 tons of finished sugar, and 25,972 tons of after

products calculated upon the basis of white crystals—forming what is known as the "free reserve" under the conditions of the State control of the sugar industry. There will thus be an available supply of sugar of 1,368,842 tons, which is 257,810 tons over the "nominal profitable production" stipulated by the Ministry of Finance, as the quantity for the campaign for 1906-07.

Of the afore-mentioned quantity of 1,386,842 tons, 838,710 tons are destined for the supply of the home market, and 112,903 tons to form the inviolable reserve, the remaining quantity of 435,229 tons being a "free reserve" available for export, or to be carried forward under the conditions explained in my report for 1903 (Annual Series No. 3480, page 28), where particulars of the State control of the sugar industry are given.

The actual area under beet was 1,425,110 acres, which gave a yield of roots of 10,145,820 tons or 142⅕ cwts. per acre. When compared with 1905 there was an increase of area of 100,570 acres, or 7·6 per cent., and in yield of roots the enormous increase of 2,365,533 tons, or 30·4 per cent. The yield per acre of 142·2 cwts. of roots with an output of 13 per cent. of sugar thus gave 18·5 cwts. of sugar per acre.

The following table gives detailed particulars of area, yield, &c., as well as the number of factories in the beet-growing districts of Russia:—

Table showing Area and Yield of Beetroot, the Yield of Sugar from Roots, and the Number of Factories during the Year 1906.

	Beetroot.		Yield of Sugar from Roots in 1000 tons.	Number of Factories.
	Area in 1000 acres.	Yield in 1000 tons.		
Kieff	393	2690	338	74
Volhynia	74	468	67	16
Podolia	308	2137	283	52
Bessarabia	3	18	2	1
Kherson	20	172	19	2
Kursk	165	1217	151	21
Poltava	29	169	19	7
Kharkof	145	1125	138	27
Chernigof	62	410	59	13
Four Provinces in Central Russia	71	469	53	17
Nine Provinces in Poland	156	1269	166	48
Total	1426	10144	1295	278

When the Brussels Convention came into force in 1903, Russia (although not a party to the Convention) following the example of the other sugar-producing countries of Europe, in 1904 considerably reduced the area under the cultivation of beetroot in order to curtail the over-production of sugar. This restriction has been of short duration, the area having been increased in 1905 by 141,224 acres,

and in 1906 by 100,570 acres, or together showing an increase over 1903 of 241,794 acres. The yield of roots in the same time has increased by no less than 2,757,078 tons, or 59·2 per cent., while the production of sugar from 824,065 tons to 1,286,456 tons, equal to 56·1 per cent.

It is difficult to foresee what this over-production of sugar in Russia will lead to. The quantity of sugar for consumption in Russia is prescribed by the Government, who also fix the price limit at which it must be sold. The home consumption increases very slowly—the average for the last 10 years shows a yearly increase of 40,323 tons, but 1906 shows an increase of only 21,984 tons.

The average cash price upon the Kieff market in 1906 for white crystals for the home market was £1 7s. 9d. per cwt. during the first eight months, and £1 6s. 1d. per cwt. during the last four months, with delivery at the nearest railway station. The limit prices fixed by the Ministry of Finance for these periods were £1 8s. and £1 7s. 1d. per cwt. respectively. The fixed limit price was exceeded on two occasions during the second period, viz.: at the end of October, when 32,258 tons was ordered to be taken from the "inviolable reserve" for the home market without paying the extra excise duty, and again on December 21, when 64,516 tons from the "free reserve" was also ordered to be put upon the home market, thus increasing the quantity decreed by the Government for the home consumption by 96,774 tons, or to a total of 935,484 tons.

The actual quantity of sugar sold for home consumption in 1905-6 was 857,018 tons, made up of 567,286 tons of refined and 289,732 tons of white crystals, being 21,986 tons, or 2·6 per cent. more than in the previous year. The consumption for the last four years has been as follows:—

Year.	Quantity. Tons.	Increase. Tons.	Per cent.
1901-02	697,120	50,109	7·7
1902-03	721,787	24,667	3·5
1903-04	752,249	30,462	4·2
1904-05	835,032	82,783	11

Taking the present population of Russia as being 132,000,000, the consumption of sugar in 1906 equals, say, 14 lbs. per head of the population.

The price of refined sugar upon the Kieff market showed a slightly downward tendency; for the first three months the price was £1 15s. 10d. per cwt.; by the end of March there was a decline to £1 15s. 3d. per cwt., and this price was maintained until the beginning of October, when there was a further drop to £1 14s. per cwt. which held good until the first week of December, when £1 13s. 3d. per cwt. was quoted, and this price held good until the end of the year.

The quantity of sugar exported from Russia in 1906 as given by the Association of Sugar Manufacturers was 62,845 tons, a very

considerable decline when compared with the exports of former years. The following shows the different countries and the quantities exported to each during the last four years:—

	Quantity.			
	1906. Tons.	1905. Tons.	1904. Tons.	1903. Tons.
Finland	5,352	18,461	34,421	97,823
Persia, Northern	50,579	50,890	51,685	63,575
Turkey	201	17,170	51,554	30,412
China	3,865	6,309	5,061	1,050
Afghanistan	200	248	315	530
Germany and Austria-Hungary (in transit)	2,627	4,120	26,905	43,044
Other countries	21	36	302	239
Total	62,845	97,234	170,243	236,673

The considerable decrease in the export to Turkey—from 51,554 tons in 1904 to 201 tons in 1906—is ascribed by the Association of Sugar Manufacturers to the successful competition of the sugar of Western European countries, and principally from Austria-Hungary.

As mentioned in previous reports, the markets of Western Europe are, since September, 1903, through the action of the Brussels Convention, closed to Russian-made sugar. The rapid decline in the export trade, as shown by the above table, taken together with the increased production of the last campaign, clearly shows that all is not well with the industry, and steps must ere long be taken to put this important and rapidly increasing industry upon a sounder and healthier basis, if a serious crisis is to be averted. Suggestions have been made that Russia should become a party to the Brussels Convention, but before this can be done the State control, which is considered as being a secret bounty, must be got rid of.

In my report of 1903 (Annual Series No. 3480, page 28), reference was made to the Government's willingness to allow the sugar factories to dispose of denaturated sugar during the next three years for cattle feeding and industrial purposes. From a report just issued it appears that this concession was only taken advantage of to fatten the cattle belonging to several of the sugar factories, the general body of agriculturists having made no use of it. The quantity of sugar denaturated during the three trial years, 1903-05, equalled 175 tons, which was mixed with bran, chaff, oil cake, &c.

Notwithstanding the non-success of these trials, application has been made to have the permission to use sugar free of excise duty extended for a further term of three years, and in this way an outlet may be found for a portion of the over-production of sugar, which under the present low prices ruling on the markets of Europe cannot be exported unless at a great loss.

Among the beet sugar-producing countries of Europe Russia now stands first as to the area of land under the cultivation of beet, second as regards the total yield of roots and of sugar, and also as regards the number of factories engaged in the manufacture of sugar, but the lowest as regards the yield of roots and yield of sugar to the acre.

The local Sugar Association found it necessary in 1906 to draw the attention of the Russian Government to certain malpractices prejudicial to the export of Russian-made sugar into Finland. The Russian customs reported the quantity exported to Finland in 1905 as being 18,460 tons, while the Finnish customs reported the quantity imported to Finland from Russia as 32,625 tons, a difference of 14,165 tons. (Russian sugar enjoys a preferential duty of 14s. 6d. per cwt. upon entering Finland.) It would appear that German-made sugar was being imported into Finland from Hamburg as Russian-made—the market price in Hamburg was then equal to 10s. 5d. per cwt., freight and other charges to Helsingfors equalled 6d. plus the preferential duty 14s. 6d., or £1 5s. 5d. per cwt. The price then obtainable in Helsingfors was £1 9s. 5d. per cwt., so that the Hamburg exporters made a profit of 4s. per cwt.

It is assumed that Russian-made sugar, declared during the years 1900-04 as being in transit from Hamburg to Finland, was despatched elsewhere—most probably to Japan—after being repacked in other packages; that the Russian sacks as well as the Russian customs certificates of origin remained in the hands of the German middleman, who made use of them in 1905 to ship German-made sugar to Finland. In my report for 1903 reference was first made to the anomaly in the increase of export of Russian sugar to Germany and Austria-Hungary in transit, and of the sugar then being exported as of German or Austro-Hungarian origin. (Annual Series No. 3480, page 26.)

Such malpractices not only affect the Russian sugar trade—the revenue of Finland also suffers by losing the difference in the import duty which German-made sugar should pay, and in order to stop the recurrence of such action it has been decided that the validity of Russian customs export certificates shall be limited to two months from date of issue.

It would be idle to deny that the trade of this district is most seriously affected by the shortage of railway rolling-stock, which is now unfortunately accepted as a chronic condition of affairs. During 1906 there was little or no improvement on the serious condition described in my report of 1905—by the beginning of 1906 the Russian railway system had to face 200,000 truck loads of goods lying at stations awaiting transport. This was aggravated by the preference which had to be given to the transport of grain to the famine districts, the return of troops from the Far East, and the carriage of fuel and raw materials to the various centres of industry. It is stated that

the sugar industry of this district alone requires sufficient rolling-stock to transport about:—

	Quantity. Tons.
Coal	516,129
Limestone	209,677
Beetroot	564,516
Raw sugar to refineries	435,484
Refined sugar for consumption	322,581
Total	2,048,387

In order to relieve this congestion the Kieff Sugar Association in 1906 petitioned the Ministry of Ways and Communications to allow them to acquire their own rolling-stock, and to grant special rates to recoup them for the outlay of capital, &c. The Ministry could not agree to the proposal and ordered 62 locomotives and 1,150 trucks to be sent to the relief of the South Western Railway. By the middle of October the quantity of goods lying at the stations of the South Western Railway equalled 24,000 truck-loads, and steps were then taken to ensure the grain, sugar, &c., being properly covered, and in December there were still 20,000 truck-loads awaiting transport.

Grave fears are entertained that the sugar industry is on the eve of a serious crisis. The immediate cause is said to be due to the fact that the Government, acting upon information communicated by interested speculators, ordered 64,516 tons from the free reserve to be put upon the home market last December in virtue of the conditions of the State control of the sugar trade. The result has been to bring down the market price from £1 6s. 2d., as fixed by the Ministry of Finance, to £1 5s. 9d. and less per cwt.* Serious consequences have followed this step, buyers, who contract for sugar at the higher price, find it convenient to object to the poor quality or "the bad colour" of the sugar and refuse to accept delivery. The factories or sellers, now faced with a drop of 2s. to 2s. 3d. per cwt. and a glutted market, find it impossible to dispose of their products unless at a serious loss. This happening at the close of the manufacturing season, with large amounts payable for excise duty, the settlement with the planters for the roots supplied, as well as the approach of the annual settling for the goods supplied during the year, put many of the sugar factories to serious financial straits, and the general trade during the "contracts" or annual "fair" held during February (O.S.) was listless and depressed; money was scarce—a condition solely due to the stagnation in the sugar industry which is the mainstay of the South Western District of Russia.

* The fixed price of £1 6s. 2d. only held good until December 31. On January 1, 1907, the higher limit price of £1 8s. came into force.

CONSULAR REPORTS.

JAVA.

The year 1906 may, on the whole, be considered a fairly satisfactory one. The sugar crop, on which the prosperity of the island to such a large extent depends, and which it was at first feared would be short, has turned out better than was expected.

Good results have generally been obtained with the other cultures and products.

The following figures show the production of sugar in Java during 1906 as compared with the previous year:—

	Quantity. 1906.		Quantity. 1905.
	Acres.		Acres.
Planted area	260,810	....	258,391
	Tons.		Tons.
Total production.. .	1,046,691	...	1,021,599
Production per acre ..	4·01	....	3·95

Four new mills delivered their first sugar during the year, while two mills were shut down, so that the area planted by the remaining ones was approximately the same as in 1905.

The weather was not favourable, a late wet season being followed by unseasonable rains during the grinding season.

Mr. Vice-Consul Thomson reports as follows regarding cane diseases:—

"The 'yellow stripe' disease still requires the full attention of planters. No remedy has so far been discovered, though it has been generally stated that the tops of fully-grown cane give plants that are less subject to this disease than plants grown from young shoots.

"Notwithstanding the fact that the final results for 1906 are due to the seed cane, which generally speaking gave an abundant cane production, symptoms of deterioration have been observed in the principal varieties of seed-grown cane, and some of these, which a few years ago were relied upon by planters for their main crop, are now considered rather unreliable, and a certain amount of uneasiness prevails in cane-growing circles as to what course should be taken should these seedlings have to be abandoned before trustworthy substitutes can be developed by the experimental stations."

Considerable improvement has again been made in the equipment of the mills, both by enlarging their capacity and by perfecting their installation.

Although cattle disease was only sporadic, the application of rail-tracks for cane transport again made considerable progress. The benefits derived from this method of transport are so obvious, that practically all mills are now adopting this system.

China.

Newchwang.—Sugar is a very important item in the import list of Newchwang, and Japan is making a strong bid for the market. The import in 1905 of sugar of all kinds was 508,852 cwts., valued at £304,639, and in 1906, 286,455 cwts., valued at £173,450. Of these quantities the imports from Hong-Kong were :—

Year.	Quantity. Cwts.	Value. £
1905	384,410	224,608
1906	229,496	135,264

The imports of sugar from Japan were :—

Year.	Quantity. Cwts.	Value. £
1905	30,347	17,371
1906	42,557	28,289

Madeira.

The British Consul reports :—

A special law was made in 1903, and guaranteed for 15 years, to stimulate cane production, the primary object being the manufacture of sugar for internal consumption and export to Lisbon, and secondarily the manufacture of cane brandy for local use.

There are at present two up-to-date factories, by far the larger and more important of which is British. This latter produces all the sugar manufactured and the larger proportion of alcohol for the treatment of wines. The other factory produces cane brandy and the remainder of the alcohol required by the wine trade.

In addition to these there are 50 small rudimentary mills, mostly driven by water and cattle, spread all over the island, which manufacture cane brandy for local consumption.

In view of the above-mentioned law of 1903, the two large factories sign a contract with the authorities annually in which they bind themselves :—First, to buy all cane offered them at the very high price of $16 (£3 11s.) per ton ; second, to buy from the small mills at the end of the year at a high price stipulated by law, any excess of cane brandy they have not been able to sell during the year.

In consideration of these responsibilities, the two large factories have the following compensations :—First, the monopoly of the manufacture of sugar, and also of alcohol for the treatment of wines ; second, the right of importing molasses at a reduced duty of $6 per ton, out of which a small quantity of sugar is first extracted and the refuse made into alcohol ; third, the right of exporting all sugar made from Madeira cane to Portugal free of duty.

The duties are very high, all foreign sugar above 20 Dutch standard paying 160 dol. (£35) per 1000 kilos. (one ton) and below that standard 135 dol. (about £30).

It is only owing to these heavy protective duties that cane production can be made profitable in Madeira, as artificial terraces have to

be constructed to keep the soil from being washed away and the price of irrigation water is enormous.

Up to 1903, when the law was published, all the cane grown annually on the island was only sufficient for eight months' local consumption of sugar and brandy.

Under these circumstances, it was possible for the two large factories to undertake the purchase of cane at the stipulated high prices, as they had their compensation in the importation of molasses.

But the effect of the law of 1903 has been to give such an extraordinary impetus to the plantation of cane that the production has now more than doubled.

The entire crop was calculated as follows:—

Year.	Quantity. Tons.	Value. £
1903	19,000	56,000
1904	—*	—*
1905	28,000	98,000
1906	33,000	125,000

The result of this over-production has been that very little molasses has been imported, and the manufacturers find themselves in great difficulties, as whilst having to buy a much larger quantity of cane, and being inundated with cane brandy at the end of the year, their compensation of importing molasses has nearly disappeared.

This year (1907) the only sugar factory on the island will produce sufficient sugar for 2½ years' local consumption, and a large quantity will have to be exported to Portugal. But there is a difficulty about this. According to the law itself, it is clear that at least one-half of the sugar consumed locally can be made from imported molasses, without rendering any part of the Madeira cane sugar "subject to duty" when exported to Portugal. The official instructions regulating the application of the law appear to indicate that if any sugar is made and consumed in Madeira from imported molasses, duty must be paid on an equivalent quantity of Madeira cane sugar exported to Portugal; and this, from an industrial point of view, is financially impracticable.

Another difficulty also meets the two large factories in their obligation to buy the excess of cane brandy from the 50 small mills. Not satisfied with the guarantee that the law gives them of the purchase at a higher figure than market price of any natural excess at the end of the year, some of these small mills produce enormous quantities of brandy with the sole idea of delivering it to the two large factories. These latter are making a determined stand against what they consider an abuse, and claim that they are only called on to accept the natural excess of cane brandy, and this only under certain equitable conditions.

* At about the same as 1903.

As a certain class is using every effort to induce the Government to prohibit the importation of molasses in Madeira, notwithstanding that this importation is guaranteed to 1919, and as the molasses comes from British possessions in the West Indies, there is no doubt that it is of importance that the entire law of 1903 should be maintained.

All sugar on the island is manufactured still by the Hinton-Naudet process of diffusion of the "megass" by forced circulation, and this process has been still further improved this season, so that all the juice is extracted from the cane with a loss of only about 0·26 per cent.

PUBLICATIONS RECEIVED.

BEET SUGAR, MANUFACTURE AND REFINING. In two volumes. By L. S. Ware. New York, John Wiley & Sons; London, Chapman & Hall, Ltd. Volume II. 21/- net.

The volume under review, which treats of Evaporation, Graining, and Factory Control, is the second of the two. It is divided into seven parts, with an appendix of useful tables and an index. In the first part, which is Part IV. of the whole book, the author discusses several typical German and French forms of multiple effects, from theoretical and practical points of view; the methods of heating with coils and calandrias; condensers, vacuum pumps and other accessories; carbonatation, reheaters for juice and syrups; with the working arrangements which lead to the most satisfactory results. The chapters relating to the theoretical and practical calculations, chiefly from the experience of Horsin-Déon, Dessin, Claassen, and Jelinek are particularly well written, and deal somewhat fully with the questions under discussion. The engineer and designer of sugar factory and refinery plant, as well as the sugar manufacturer, will find in them valuable information respecting the best proportions for the necessary apparatus, and the direction in which to look for greater economies than have yet been obtained, in the matter of sugar losses and steam and fuel consumption.

Part V. deals with the graining, curing, handling, and storing of raw sugars, and with the pans and apparatus in use for these processes. The chapter on graining furnishes information, which even the most expert boiler will find useful. The methods for controlling the process, and the efforts of Curin, Claassen, and others, recently proposed to make boiling and graining more automatic, are fully described. The author treats of after-products in Parts VI. and the different methods of crystallization, with and without motion; graining, returning to first products and curing the masse-cuite.

In Part VII. the Continental methods of refining, for the production of white sugar in loaves, cubes and granulated, are discussed; as

well as the recovery of sugar from the syrups, and other matters. The newest processes in the manufacture of cakes, bars and cubes are described in a carefully written chapter.

The treatment of molasses for the recovery of sugar is the subject of Part VIII. Dubrunfaut's osmose process and the various lime processes are described in some detail, and mention is made of the strontia, baryta and lead processes. According to the author, however, the three last have not yet been economically successful, chiefly because of the cost of the chemicals required.

Part IX. relates to steam generation and heat economy. And in Part X., which is the last, the author deals with various details in the management and control of a beet factory. The methods of calculation and formulae recorded in Chapter V., which are chiefly from Claassen's experience, are simple and practical. They should be useful to all who interest themselves in the principles underlying the economic working of any sugar industry.

If we may say so, the spelling in this volume is peculiarly American, but it is nicely got up and well printed, if we except a few errors. The drawings and engravings of plant and apparatus are particularly well done and simply described. Mention is made of lime kilns and carbonic acid plant, but as these are necessary adjuncts of a beet factory, we think a description of them would have rendered the volume more complete. The author, although perhaps not a practical manufacturer, has had a unique experience in the inspection and study of beet sugar factories, therefore his volume, which is brought well up to date, betrays in every chapter an intimate knowledge of the subject. He seldom expresses a personal opinion but confines himself to quoting from the writings of the best known authorities who have studied the several departments of the industry. Little or no notice is taken of British and American types of machinery, but this is perhaps excusable in a book which deals wholly with the continental sugar industry. Apart from this the book cannot fail to be helpful to all persons engaged in the cane sugar industry, whether it be the production of raw or refined sugar. The great advance which has taken place in the beet sugar industry during recent years, and the researches which have been brought to bear upon it, makes the study of it by those engaged in the sister industry an imperative necessity, and this book will certainly help in that direction.

THE POCKET GUIDE TO THE WEST INDIES. By Algernon E. Aspinall. 316 pp. London, Edward Stanford, Long Acre.

Those who have not the means nor the opportunity of paying a visit to the West Indies had better not study Mr. Aspinall's new work; they are likely to feel too keen a disappointment at not being able to follow up the information. But those who can go want no better guide book, and they would be advised to get a copy before they so much as purchase a travelling outfit.

For that question which troubles all would-be travellers to a new region—what must we take with us?—is satisfactorily answered in the chapters on "General Information." And having told us how to get there, the author next proceeds to describe our island colonies with a sufficient wealth of detail as to prove instructive and entertaining without becoming tedious. That he writes with a love of his subject is evident. The volume is well illustrated from excellent photographs, some of them taken by Mr. Aspinall himself, but we are glad to see that he has not confined the views to those already published by him in his series of postcards, but that he gives us some new and interesting ones.

In describing the size of the various islands, mere figures of area are apt to convey nothing to the home reader; he wants to have them compared with places that he is familiar with. Mr. Aspinall seems to have realized this for he does not fail to give us some information of the kind; thus we learn that Barbados is rather larger than the Isle of Wight, while Trinidad is rather smaller than Lancashire.

But the feature of the guide is undoubtedly the excellent series of maps. Besides a general one of the West Indies, such as we find in our home atlases, there are large-scale ones of the chief islands and also of British Guiana, which cannot fail to be of use whether for tourists or for commercial houses dealing with the districts concerned. A casual inspection of the general map of the West Indies reveals the strategic importance of Jamaica to the new Panama Canal. In the light of this fact we have every reason for keeping a tight hold on the island, for if England once allows Jamaican sympathies to be transferred to the United States and loses the colony as a consequence, it is evident that the Americans will have an uninterrupted approach to the canal and will practically command the situation.

British Guiana and its Resources. By Professor J. B. Harrison, C.M.G. London, The West India Committee, 15, Seething Lane, E.C. Paper Covers, 40 pp., 6d.

To quote Mr. Algernon E. Aspinall who writes the preface, Professor Harrison has for more than eighteen years "been intimately connected with British Guiana, and he is therefore well qualified to speak regarding the varied resources of the colony. Appointed originally as Government Analyst and Professor of Chemistry of British Guiana, Professor Harrison has dealt with a wide range of subjects and he has made a geological survey of the more important districts of the colony, of a scientific and practical nature, which has been published and has already proved of immense value. He now holds the important office of Director of Science and Agriculture of British Guiana."

We may therefore assume that what he has got to say in this little brochure will be of undoubted value to the intending visitor to or settler in that colony. After a brief description of the geographical position of British Guiana, Professor Harrison deals with the following

in order and at some length: Agricultural Resources; Forest Resources; Mineral Resources, and finally Power Resources. Under "Agricultural Resources," sugar takes chief place. We observe that the author speaks of B 208 as "a very good cane." Amongst minerals we note that diamonds are by no means scarce but that their exploitation is dependent on the reduction in the present high cost of transport. "Power" lies dormant in the great rivers which traverse the colony and which possess great falls and very extensive cataracts. These are certain one day to receive the attention of the electrical engineer with beneficient results.

We may remark in conclusion that an excellent reproduction of a photograph of Professor Harrison forms a frontispiece to the pamphlet.

Handboek ten Dienste van de Suikerriet-Cultuur en de Rietsuiker-Fabricage op Java. Tweede Deel: de Dierlijke Vijanden van het Suikerriet en hunne Parasieten (Handbook of the Methods in Use among the Sugar Cane Cultivators and the Raw Sugar Manufacturers of Java. Part II.: The Animal Pests of the Sugar Cane and their Parasites). By W. van Deventer. Quarto, 300 pp. Amsterdam: J. H. de Bussy. 25s.

The scientists of Java are noted for the elaborate and expensive handbooks they publish from time to time. The present volume, the second one of a large work, deals in its subject with a detail that has never surely been approached let alone surpassed. Practically every animal pest which is known in Java is described and, what is still more to the point, carefully illustrated. We have here some 42 plates, nearly all in colour, depicting birds, beetles and their larvae, butterflies and moths with their caterpillars, and sundry other types of flies, as well as illustrations of the numerous parasites which prey on these pests. Obviously as the work is limited to the species found in Java, it cannot claim to be a complete record of sugar cane pests; but we think that most other tropical sugar planters will find much in these pages that applies to their own local needs. We note amongst others mention and illustration of *Xyleborus perforans*, *Spodoptera mauritia*, *Diatraea striatalis*, and *Aphis sacchari*. In any case the great wealth of detail found in the illustrations will make the book worth having, even if the reader has only a smattering knowledge of Dutch, in which language the work is written.

The Anglo-Ceylon and General Estates Company have had a satisfactory year, and have just paid a dividend of 8%, carrying forward the sum of £40,908. In all, 139,142 tons of canes were handled on their sugar estates, yielding 14,815 tons, against 11,308 tons of sugar from 111,135 tons of cane in 1905-06.

Correspondence.

NON-CHEMICAL SUGAR.

To the Editor of "The International Sugar Journal."

Sir,—In the current number of the *Journal of the American Chemical Society* appears a courteous review of my recent work, "Science in Sugar Production," from the pen of Dr. Wiechmann, in which the reviewer questions my use of the term "non-chemical sugar." It may interest him and others to know that this term is applied in the West Indies to such sugars as can be produced without the use of chemicals other than temper lime, and which are thus distinguished from yellow and white crystals obtained from sulphured juices, with or without the addition of salts of tin.

Yours faithfully,

T. H. P. Heriot.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Application.

12762. J. J. Eastick, London. *Process of purifying and making invert sugar and syrup.* 3rd June, 1907.

Abridgment.

660. H. W. Aitken and W. Mackie, both of Glasgow, N.B. *An improved roll for sugar-cane mills.* 10th January, 1907. This invention has for its object to provide an improved form of roll for use in conjunction with a plain roll or rolls, and which while permitting free escape of the exuded juice before it can be re-absorbed by the cane also effectively splits and crushes the cane.

GERMAN.—Abridgments.

181580. Fritz Scheibler, of Aix-la-Chapelle. *An apparatus for freeing from dust the face of the sugar in cube chopping machines or saws.* 17th March, 1906. This is an apparatus for use in machines for chopping and sawing cube sugar for removing the dust from the face of the cubes, and this is done by means of an artificially produced air jet being directed against the face of the sugar by means of a pipe shaped like a nozzle, the slotted aperture of which pipe extends over the entire width of the sugar slab, the said pipe being arranged behind the chopping knives.

183966. Dr. Carl Pfeiffer, of Wendessen, and Dr. Henry Bergreen, of Schottwitz. *An apparatus for re-utilizing diffusion water.* (Patent of Addition to Patent No. 147443). 30th September,

1906. This is a modification of the arrangement for re-utilizing the water from the diffusion process described in the previous Patent No. 147443, and consists in two further tanks being provided in addition to the collecting tanks for the water expressed and the water under pressure, from one of these two further tanks the water serving for mashing is withdrawn and may be fed alternately from the tank containing the expressed water and the water under pressure, whilst the other one of the further tanks hereinbefore mentioned, from which the water is drawn for expressing, is filled alternately from the tank containing water under pressure and with fresh water.

Fowler's steam ploughing apparatus is said to be capable of doing at least five acres of sugar land per diem even though the soil has not previously been ploughed to any depth. When the land is treated a second time it will be found that 10 acres can be turned over in the same period of time.

Willett & Gray report that a central cane sugar factory is to be erected in the Republic of Columbia on the Hacienda San Joaquin de Sincerin, near Cartegena, and connected with that port by a ship canal. It is eventually intended to have over 4000 acres under cane cultivation. Most of the machinery has already been ordered, and will comprise plant for refining sugar and distilling rum and alcohol. The Government will subsidize the factory and a rapid development of the sugar industry is expected.

Amongst those who have made their voice heard in support of a continuation of the Brussels Convention, the Bishop of Trinidad has been a conspicuous example. In writing to the leading papers at home and expressing the hope that the matter might be reconsidered by the Government, he declared that while episcopal interference in political questions might be objected to, this was a case of life or death to an already long-harassed industry, and also as a consequence a similar matter to the various islanders.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of June, 1906 and 1907.

IMPORTS.

Raw Sugars.	Values. 1906. £	Values. 1907. £	Quantities. 1906. Cwts.	Quantities. 1907. Cwts.
Germany	4,796,495	4,279,559	2,036,577	2,003,060
Holland	47,154	84,509	17,868	37,715
Belgium	232,683	203,124	92,754	90,529
France	158,805	227,418	67,251	114,812
Austria-Hungary	151,940	262,213	62,135	118,217
Java	158,997	157,294	73,466	82,521
Philippine Islands	....	145,766	....	60,000
Cuba	111,885	91,113	41,943	39,610
Peru	394,071	232,445	177,315	110,515
Brazil	915,956	185,352	359,415	76,500
Argentine Republic	....	....	....	....
Mauritius	52,523	358,233	20,368	146,839
British East Indies	61,626	70,711	24,110	30,460
Straits Settlements	38,947	106,720	16,534	44,434
Br. W. Indies, Guiana, &c.	1,141,912	956,022	622,730	553,122
Other Countries	159,110	462,692	72,679	230,053
Total Raw Sugars	8,422,104	7,823,171	3,685,145	3,738,387
Refined Sugars.				
Germany	5,996,536	6,722,746	3,406,385	3,947,000
Holland	1,364,592	1,303,867	811,752	817,009
Belgium	195,625	159,347	113,049	96,697
France	1,093,058	1,852,441	608,845	1,076,227
Other Countries	436	1,561	323	1,143
Total Refined Sugars	8,650,247	10,039,962	4,940,354	5,938,076
Molasses	1,334,468	1,415,087	255,380	268,976
Total Imports	18,406,819	19,278,220	8,880,879	9,945,439

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	127	292	114	220
Norway	8,592	7,450	5,161	4,431
Denmark	53,726	55,280	27,109	29,572
Holland	39,057	36,228	23,053	24,225
Belgium	5,208	4,326	2,881	2,566
Portugal, Azores, &c.	17,831	13,081	9,636	7,204
Italy	20,461	11,111	10,496	5,828
Other Countries	303,136	226,940	195,259	167,270
	448,138	354,708	273,709	241,316
Foreign & Colonial Sugars				
Refined and Candy	21,859	16,242	13,342	10,799
Unrefined	118,389	47,811	61,020	28,535
Molasses	5,302	4,031	1,638	1,161
Total Exports	593,688	422,792	349,709	281,811

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to July 18th ..	1,278,875	..	1,175,442
Receipts of Refined ,, ,, ...	620	..	1305
Deliveries ,, ,, ...	1,241,380	..	1,203,365
Consumption (4 Ports, Exports deducted) since January 1st..	1,044,510	..	1,033,775
Importers' Stocks, July 17th..	37,495	..	30,610
Total Stocks, July 24th	326,000	..	322,460
Stocks in Cuba, ,, ...	179,000	..	148,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1906 AND 1907.

(Tons of 2,240lbs.)	1906. Tons.		1907. Tons.
Exports	855,903	..	1,130,255
Stocks	249,544	..	239,151
	1,105,447	..	1,369,406
Local Consumption (six months)	22,100	..	22,970
	1,127,547	..	1,392,376
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 30th June..	1,108,097	..	1,392,376

Havana, June 30th, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR SIX MONTHS ENDING JUNE 30TH.

SUGAR.	Imports 1905. Tons.	Imports 1906. Tons.	Imports 1907. Tons.	Exports (Foreign) 1905. Tons.	Exports (Foreign) 1906. Tons.	Exports (Foreign) 1907. Tons.
Refined	330,173	432,512	501,998	504	1,092	812
Raw	313,700	421,105	391,158	1,436	5,919	2,390
Molasses	57,925	66,723	70,754	49	265	202
Total	701,798	920,340	963,910	1,989	7,276	3,404

	Home Consumption 1905. Tons.		Home Consumption 1906. Tons.		Home Consumption 1907. Tons.
Refined	326,758	..	411,749	..	472,460
Refined (in Bond) in the United Kingdom	250,695	..	276,624	..	243,392
Raw	50,081	..	59,700	..	60,025
Molasses	56,070	..	62,977	..	61,780
Molasses, manufactured (in Bond) in U.K.	25,781	..	30,925	..	33,867
Total	709,385	..	841,975	..	871,524
Less Exports of British Refined	10,753	..	22,406	..	17,735
Total Home Consumption of Sugar	698,632	..	819,569	..	853,789

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, JULY 1ST TO 20TH, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1907.
189	602	459	358	112	1722

	1906.	1905.	1904.	1903.
Totals	2028 ..	1432 ..	1891 ..	1989

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING JUNE 30TH, IN THOUSANDS OF TONS.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1885	1245	643	553	207	4533	4143	3901

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.	1903-1904. Tons.
Germany	2,250,000 ..	2,415,136 ..	1,598,164 ..	1,927,681
Austria	1,335,000 ..	1,509,870 ..	889,373 ..	1,167,959
France	755,000 ..	1,089,684 ..	622,422 ..	804,308
Russia	1,450,000 ..	968,000 ..	953,626 ..	1,206,907
Belgium	280,000 ..	328,770 ..	176,466 ..	209,811
Holland	190,000 ..	207,189 ..	136,551 ..	123,551
Other Countries .	440,000 ..	415,000 ..	332,098 ..	441,116
	6,700,000	6,933,649	4,708,758	5,881,333

THE

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The Editor will be glad to consider any MSS. sent to him for insertion in this Journal and will endeavour to return the same if unsuitable; but he cannot undertake to be responsible for them unless a stamped addressed envelope is included.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTICE TO READERS.—If the Advertisement pages stick together, bang their edges on the table, when they should easily separate.

NOTES AND COMMENTS.

The Act Supplementary to the Brussels Convention.

The Powers concerned in maintaining the Brussels Convention have arrived at a *modus vivendi* which, if not permanent, will at least stave off a crisis for another six months. They have agreed to a Supplementary Act (*Acte Additionelle*) releasing England from her obligation to penalize bountied sugars after September 1st, 1908, and in return obliging her to guarantee the markets of the remaining Powers from the receipt of any bountied sugars refined in Great Britain. The Act has however to be ratified before February 1st, 1908, by all the Powers who do not come under the exceptional terms of Article 6, and in the event of their not doing so, it shall be open to England to denounce the Convention from September, 1908. If, however, all the Powers decide to ratify, then the Convention is to remain in force for a further period of five years from September, 1908, subject to certain rights of withdrawal. The full terms of the Supplementary Act will be found on another page.

It is obvious that the success of the new Act will depend largely on what happens during the five months ending February 1st next.

Russia has at length signified her intention of joining the Convention, and as she is the chief exporter of bountied sugar, the nature of her proposals for adhering to the Convention may largely decide the issue. If any of the Powers come to the conclusion that these proposals are not honestly conceived they may decide not to ratify by February next, in which case the remaining Powers will be at liberty to either continue the Convention among themselves or else terminate it. So far, however, Russia's terms do not seem to be in the least acceptable; and the Permanent Commission will have their work cut out for them in solving the riddle of the Russian bounty system.

But the immediate result of the Act is that Great Britain instead of having had to denounce the Convention by August 31st last, will not be required to do so before February next; and these "days of grace" may prove of great value in arriving at some more satisfactory solution.

A Java View of the Convention.

As there is a tendency in some quarters at home to attribute but little of the recent activity in the cane sugar world to the influence of the Sugar Convention, the following expression of opinion from one of the leading sugar scientists in Java is worth placing on record. He writes to us: "I wonder what will become of the "Brussels Convention if Great Britain withdraws. I do hope that "there may be found some way to keep it up, as the former state of "uncertainty as to what the beet-growing countries would do next "was just apt to paralyse every effort to go in for increased "business." This is just what we have contended all along. It has been the certainty engendered by the Convention that has rendered feasible the extensive increase in sugar plants so noticeable during the last few years. As our correspondent writes from the centre of one of the most specialized cane sugar industries in the world, and not from some conservative West Indian island, he can hardly be accused of exaggerating the influence of the Convention, and this ought to dispose of the suggestion put forward by some critics that, apart from the West Indies, the Convention has had little or nothing to do with the recent numerous orders coming from all parts of the world for new central factories.

Progress in Formosa.

We have just received an interesting letter from Mr. Hori, of Formosa, who has had many years' experience both in beet and cane sugar growing and manufacture. He was the gentleman who was selected by the Japanese Government to organize a Government

Sugar Bureau with its necessary offices for the encouragement and development of the sugar industry in Japan; from his expert knowledge of agriculture, he was also employed by the Government to establish an experimental station in the island of Formosa for the study of sugar cane cultivation. He is at present a Director and Superintendent of the Ensuiko Sugar Co., Ltd., of Formosa, and has been visiting America and Europe along with his President, Mr. Aria, for the purpose of placing an order for a complete new central sugar factory required by his Company.

The Specialist.

In an article dealing with Mauritius to be found on another page, our contributor rightly insists on the importance of expert knowledge in the sugar industry. In most countries the farmer is no less a specialist than the engineer, the chemist, or the chimney sweep; and the more attention he devotes to his field work, and the more he knows about the scientific principles which underlie his daily practice, the better farmer will he be. In most tropical countries, on the other hand, the planter (who is little more than a farmer) poses as an engineer if he can patch up a leaky joint, and considers himself a chemist if he can handle the polariscope without damaging it. Owners of sugar plantations appreciate this type of man because his salary is less than the combined salaries of an expert planter, engineer, and chemist. Instead of looking to their resident staff for new ideas they are satisfied with the imperfect methods now in use, which constitute the entire stock-in-trade of the average planter. The latter may be able to plant canes, to tinker up old machinery, and to polarize the juice, but so far from introducing any improvements himself, he will remain ignorant of improvements already existing because no one individual can keep abreast of recent progress in the various sciences called into play in the cultivation and manufacture of sugar.

New Cane Sugar Factory for Porto Rico.

Yet another instance of the success of British engineers has to be chronicled. We learn that notwithstanding the duty of 45% levied by the U.S.A. upon all foreign machinery entering Porto Rico, a contract for a complete factory to deal with 300 tons of cane per day has been placed with the Mirrlees Watson Co., Ltd., Glasgow. The purchasers have had experience of both British and American made machinery, and are satisfied that it is to their advantage to pay the very high duty named above upon British machinery instead of purchasing American made machinery. This plant consists of a 6-roller 26 in. × 54 in. mill driven by one engine, provision being made for the addition of another set of mills and Krajewski Crusher

at a subsequent date. The steam raising plant consists of 4 multi-tubular boilers with green megass furnaces arranged for natural draught, and iron chimneys made sufficiently large to permit of the plant being increased in capacity at an early date. The juice leaving the mills will pass through juice heaters to clarifiers, from the clarifiers to the defecators, and from the defecators to a triple effet containing some 5000 sq. ft. heating surface.

There will be a vacuum pan to strike 5 tons dry sugar with all necessary pumps, staging, etc., and three 30 in. water-driven centrifugals are to be provided with molasses pumps, conveyors and elevators. Filter presses, electric light, cooling towers, and injection pumps, etc., will also be supplied.

British Equipped Sugar Factories for Formosa.

Last month we mentioned that the Harvey Engineering Company, Ltd., had received an order for a Central Sugar Factory for the Island of Formosa from the Meiji Sugar Manufacturing Company of Tokyo. It now appears that the design and arrangement of this factory by this Glasgow firm was selected by the sugar expert of the Meiji Sugar Manufacturing Co. as the best in design and arrangement of all the plans put before him, and included a nine-roller mill and crusher, and it was only when the order was placed that intimation was given that the milling plant had been already ordered in America. However, barring the milling plant, the factory, including the buildings, is entirely of British design and manufacture.

Another Japanese firm, namely, the Ensuiko Sugar Company, have decided to erect a large complete central factory, also in the island of Formosa, and the President, Mr. Aria, and Mr. Hori, the Director and Superintendent of this Company, have been instructed by their co-directors to visit the sugar engineering firms in America and Europe, with the view to placing the order for this factory, and to receive specifications and estimates for the same, and, after due consideration, have selected the Harvey Engineering Company's plan as the most suitable, and therefore placed the order with them.

ERRATUM.

In the table on page 418 (August) the first two columns referred (as usual) to *quantities* and not to *values* as shown. The headings were inadvertently transposed.

THE GOVERNMENT AND THE CONVENTION.

Ministers seem not altogether comfortable about their position with regard to the Sugar Convention. If the question could be tried in a Court of law they would inevitably break down in cross-examination. They never had a real sound leg to stand upon, and their artificial crutches have been getting dangerously weak. Their prophecies have turned out false, their facts have proved to be fiction, and their arguments, like their political economy, have broken down. If this could be made clear to the man in the street there would be some hope of substituting a sounder and saner policy. Fortunately for the Government they know that the British public is slow at distinguishing between fact and fiction, and they believe that fiction, which has put them in office, will still continue to be their best support.

The short debates in the House of Lords, on the 13th May and 3rd July, furnish some confirmation of these assertions. Lord Denbigh, in two excellent speeches, has brought forward the question of producing beetroot sugar in this country, and has pointed out how essential it is that the Convention should continue in force if people are to invest money in sugar production. Incidentally he expressed the hope that, in addition to the maintenance of the Convention, some slight rebate in the excise duty might be conceded in order to give a start to a new industry. This part of his scheme we will not deal with at the moment, but merely confine ourselves to an examination of the declarations of the Government with regard to the Convention.

Lord Denman, who was the first to reply to Lord Denbigh, declared that "it was not by politicians alone that the Brussels Convention was disliked. It was loathed and detested by all the sugar-using trades." He seemed to forget that the largest sugar-using trade is that of sugar refining, which uses more than 600,000 tons, and in former days used more than 800,000 tons. Converting raw sugar into refined sugar is a more important industry than converting refined sugar into sugar plums. The sugar refiners do not "loathe and detest" the Convention. They know that it is a free trade measure and beneficial to consumers as well as to producers; and they have good sound reasons for the faith that is in them, which they have stated constantly for the last 35 years and which no one has ever been able to refute. But Lord Denman does not seem to know this—though he would find the Blue Books full of it—but pins his faith on the following extract from "one of the communications received at the Treasury," which show what the attitude of the sugar-using trade was :—

"Despite all the professions of the authors, the price of a prime commodity to the poor has been doubled, and the purchasing power of the worker's wage has thus been lessened; great industries are

threatened with ruin, honest trades have their positions jeopardised, and the gaunt army of the unemployed has been increased."

This romance Lord Denman regards as conclusive. Then he tells the House his own personal experience of the Convention. His Indian tea shares are in jeopardy because, he says, "Russia put a countervailing duty on tea grown in India and Ceylon." Therefore the shareholders and tea planters "had to pay for the benefits conferred upon this country by the Convention." How the tea duty could countervail anything he did not explain. Fortunately, Sir Charles Elliot has stated the facts in *The Times* of the 28th June, and pricked the bubble. Russia did raise the duty on tea at her western ports, but she lowered the duty at Dalny and Vladivostok; the object being to increase the traffic on her Manchurian railway. "The result has been that, while India exported two million pounds of tea to Russia before this period, the export of last year was over seven millions."

These are the sole arguments which, after much research, Lord Denman succeeds in finding in support of his condemnation of the Convention. As to the scheme for producing our own sugar in our own country and colonies, he speaks of a beetroot sugar industry as "necessarily a restricted industry in these islands." He is unaware that the continent of Europe produces annually more than six million tons of beetroot sugar, of which it sends us much more than a million. If we are to continue to consume that quantity of beetroot sugar there is no reason, so long as bounties are abolished, why we should not make a large portion of it ourselves; the rest of our consumption coming, as before, from our colonies or other cane sugar producing countries. Lord Denman should look up his subject before calling beetroot sugar "a necessarily restricted industry." He regards Lord Denbigh, therefore, as a mere "enthusiast." Ten years hence Lord Denbigh will probably be regarded as a successful pioneer.

Lord Fitzmaurice added a few words. The Government, he said, "would always look at this question from the point of view of free trade." If so, they might read with advantage the Report of the Select Committee of 1879—1880. But he adds that "the Foreign Office has nothing to do with sugar." For the last five and thirty years then, we must have been dreaming.

In the following debate of the 3rd July, Lord Fitzmaurice was the principal defender of the Government. "We are above all things," he says, "a free trade Government." The "small advantages which might possibly accrue locally by the development" of the production of beetroot sugar are as nothing compared with the advantages which the "absolute freedom of entry of sugar into this country would bring about." In other words, the advantages of producing, say, 500,000 tons of beetroot sugar for the British consumer close to his own door, by British labour on British land, would be nothing compared with

the advantage of getting, say, 20,000 or even 50,000 tons of Russian sugar instead of the same quantity of German or Austrian sugar; and at the same price, our price being always the world's price.

But Lord Fitzmaurice follows the example of Lord Denman and supports his views, not by facts or arguments but by quotation. He choses, like Lord Denman, an unfortunate quotation, because it is, like the former one, ridiculous. He says, "I remember very well the late Mr. George Palmer, of Reading, telling me, about the time the late Baron H. de Worms was engaged in negotiating a Sugar Convention, that if that Convention had been ratified the result would have been that he would have been compelled immediately to close a new branch of his works, which he had just built in order to develop the making of cakes into which a great quantity of sugar entered; and several hundred men would probably have lost their employment."

Curiously enough when that Convention was not ratified there happened to be a partial failure of the beetroot crop, and prices went up more than 100 per cent. We did not hear that Mr. Palmer's works were closed. Also, curiously enough, at the very time when Mr. Palmer made this announcement the confectioners were writing that the Convention would secure for them a better, a cheaper, and a more reliable supply of sugar than they had ever before enjoyed. Nevertheless, Lord Fitzmaurice regards Mr. Palmer's statement as a conclusive answer to Lord Denbigh's suggestion that if bounties were got rid of we could start a large and most important home industry for the production of beetroot sugar on our own soil and by our own labour. This perversity of the human mind is almost incredible, and is only to be explained by the fact that our so-called free traders imagine that free trade can only be attained by sticking to the erroneous dogma that duties must be levied solely for revenue purposes. They are unaware of the contrary fact that, as stated by a distinguished political economist. "a duty to countervail a bounty is not only consistent with free trade but positively conceived in the interests of free trade."

Lord Fitzmaurice believes "that the abolition of the system produced by the Convention and the free introduction of sugar into this country would bring about more employment than the plan proposed by the noble lord." It is difficult to understand how the substitution of the same quantity of Russian sugar for a minute fraction of the hundreds of thousands of tons of German and Austrian sugar which we now import, and at the same price, could bring about "more employment."

Lord Fitzmaurice now admits that the exclusion of Russian sugar has no effect on supply or price. "It is quite acknowledged" he now declares "by those who have studied this question that the fact that we prohibit Russian, Argentine, and Danish sugar from entering the United Kingdom does not lessen the available supply of sugar in the

world, and that sugar which would otherwise have been sent to this country finds its way elsewhere, and thus displaces sugar which, instead of being sent to those destinations, is sent to the United Kingdom." He spoils this admission, which gives away his whole case, by adding that "though there has been no actual diminution of supply, it may nevertheless be *fairly argued* that the Convention has brought about a bad result." He proceeds with his "fair argument." A case may arise, he argues, when it may be desirable for an importer to procure sugar from a special source. The penal clause may in this case inflict a real injury. The abandonment of the penal clause will relieve purchasers from such an interference with the natural course of trade and "will give the intending purchaser the knowledge that all markets are open, and that fact tends to produce an equalising effect on the market."

Here we have at last a full statement of the Government's case. They admit all that we have urged, but they still have doubts and Lord Fitzmaurice has formulated them with great care. The reply is simple and conclusive. Our prices are the world's prices, and we have at least 10,000,000 tons from which we can select our 1,600,000 tons. The knowledge that we could buy Russian sugar would, therefore, have no other effect on our market than that which the sale of such sugar now has on the markets of the world. On the other hand, the restoration of bounties would at once restore the "interference with the natural course of trade" which has been so injurious to producers and consumers for many long years.

"These are the main arguments," Lord Fitzmaurice concludes, "which have induced the Government to believe that the Sugar Convention is, on the whole, a document which has not had any good effect upon British trade."

The Government's case was evidently getting rapidly smaller. The next Minister who spoke for the defence had to invent some fresh arguments or throw up his brief. Sir Edward Grey's reply to Mr. Bonar Law, on the 1st August, showed at once the poverty of the land. All the old pretexts had broken down, and the Secretary of State was reduced to the poor little argument that we might be outvoted on the permanent Commission at Brussels, and that then "the one large consumer in a Convention where the other parties to the Convention are producers, and where the decision of the majority must prevail, may at any moment find himself in a precarious position. He may find that the tendency is to restrict the markets from which he can buy." The Government have come to their last cartridge and have fired it off—but made a bad shot.

Let us look at the facts. The permanent Commission desired to do what Sir Edward Grey suggests. They wanted to assume that every country having a surtax in excess of that prescribed by the Convention was guilty of giving a bounty, and must be penalized. The

British delegate, in a minority of one, pointed out the necessity for proving that the surtax had created a bounty before the penal clause could be legally enforced. This solitary delegate carried his point, and every country which the Commission erroneously desired to penalize was struck off the black list. In the case of Brazil, an important sugar-producing country, the British delegate took strong measures to establish his case. The Brazilian Government sent over a high official who furnished the Commission with copious details. When the Commission appeared to be unconvinced two official inquiries were instituted in Brazil itself by the British and Belgian Governments. The results of these inquiries were so conclusive that the Commission was at last convinced and gave way.

These facts are the most crushing answer that could possibly be given to Sir Edward Grey's fears,—facts, moreover, with which no one could be more intimately acquainted than the Secretary of State for Foreign Affairs.

It will be interesting to observe what line of argument will be pursued by the Government in the future, if their present hopes of patching up a mutilated Convention should not be realised. In return for the abolition of the clause which secures the foreign producers against unfair bounty-fed competition in our markets,—producers who have consented to the abolition of their own bounties on the strength of that security,—all that our Government offer as an inducement to such self-sacrifice is that our exports of refined sugar (not confectionery) shall be accompanied by a certificate that they are not the products of bounty-fed raw sugar. We consume 1,600,000 tons, all of which may, if we choose, and if such sugar existed, be the products of bounty-fed sources of supply; all that we concede is that the poor little 40,000 tons of refined sugar which we export shall be immaculate. But that is not the most ridiculous point in the bargain. Our trifling exports do not go to the markets of the contracting States; they are shut out by a surtax of 6 francs per 100 kilos. Will the parties to the Convention accept this generous and valuable *quid pro quo?*

Russia, it is said, is offering to join the Convention. Her excise (consumption) duty is 1 R. 75 per poud. There is also an imaginary extra duty of the same amount which the fabricant would have to pay if he ventured to send into home consumption any more sugar than the quantity ("contingent") permitted to him under the law. Of course he never does so. But the Russian Government have made the handsome offer to bring their surtax in accordance with the Convention, not by reckoning their excise duty at 1 R. 75, but by taking the double figure which would have to be paid on sugar not permitted by law to go into home consumption except on that impossible condition. They take this fictitious figure of 3 R. 50, and calmly ask to be permitted to join the Convention if they bring their

surtax within the legal bounds of that figure. They must be tolerably simple-minded to suppose that France, Germany, and Austria could be taken in by such a transparent trick.

Lord Denbigh, on the 5th August, again brought up the subject of the Sugar Convention in the House of Lords; and this time Lord Elgin took the opportunity of trying his hand at finding a new argument in defence of the Government. To give himself a text for his discourse he quoted, from among the Papers from the Colonies recently presented to Parliament, a resolution passed by the Barbados Agricultural Society, in which it is stated that:

"While the Convention has not led to a rise in the average price of sugar, it has restored the financial stability of the industry, and as a consequence sugar-planters are able to obtain capital for improving machinery whereby the quality of their sugar can be adapted to the changing needs of the market and the cost of production can be gradually reduced."

That would appear to any intelligent reader to be a quotation strongly in favour of the views insisted upon by Lord Denbigh. Lord Elgin evidently did not regard it in that light, in fact he introduced it with the remark that though the Papers contained many expressions in favour of Lord Denbigh's views there were others which were not so, out of which he selected the above. "I quote that resolution," he goes on to say, "to show that it is stability which has given an impetus to the sugar industry in the West Indies, and especially to the improvement of machinery. *But stability cannot be said to depend on protection alone.*"

Here the noble Lord begs the question, and he does so with insufficient information, because if he had read the Report of the Select Committee of 1880 he would have found that a duty to countervail a bounty is not "Protection." But the noble Earl, having hastily thrown that stone, runs away immediately and falls back on cheapness. "If we want to secure stability," he cries, "we must take into account not only the producers in the Colonies but also the consumers in the United Kingdom, and the great confectionery industries *to which cheap sugar is of the highest importance.*"

Lord Elgin quite forgets that the resolution from which he quoted as his text began by stating that "the Convention has not led to a rise in the average price of sugar." Truly the Government must indeed be at their wits' end to defend their mischievous action if all they have left to say for themselves on the 5th of August is this amazing confusion of ideas indulged in by Lord Elgin.

The whole of the Swedish sugar factories have formed themselves into a limited liability company. There are 21 firms concerned in it, and their estimated output for 1907 is 157,700 tons.

THE ACT SUPPLEMENTARY TO THE BRUSSELS CONVENTION.

The Permanent Commission met at Brussels on July 27th last, when the President submitted to the Committee a preliminary Draft for an Act supplementary to the Convention of 1902 for the purpose of enabling Great Britain to remain a party to the Convention. At the same sitting it was also intimated that Russia had at length manifested her intention of becoming a party to the Convention. The Commission then adjourned to enable the members to lay the Draft before their respective Governments. The Powers concerned have approved of the measure and their representatives finally signed the Draft on August 28th.

The terms of the new Act are as follows:—*

"The Governments of Germany, Austria, Hungary, Belgium, France, Great Britain, Italy, the Grand Duchy of Luxemburg, Holland, Peru, Sweden, and Switzerland, having agreed to conclude a supplementary Act to the Convention of March 5, 1902, relating to the sugar régime, the undersigned, duly authorised, have come to the following agreement:—

"Article 1.—The contracting States engage to maintain the Convention of March 5, 1902, in force for a further period of five years, from September 1, 1908. Nevertheless, it shall be open to any one of them to withdraw from the Convention after September 1, 1911, by giving notice one year in advance, if, at the last sitting held by the Permanent Commission before September 1, 1910, it decides that circumstances render it necessary that this facility be given to the contracting States. For the rest, the provisions of Article 10 of the Convention of March 5, 1902, concerning the denunciation and renewal of the same, remain in force.

"Article 2.—As an exception to Article 1, Great Britain shall be released, from September 1, 1908, from the obligation contained in Article 4 of the Convention. From this same date the contracting Powers shall have the right to exact that, in order to obtain the benefits of the Convention, all sugar refined in the United Kingdom and exported to their countries shall be accompanied by a certificate to the effect that no portion of such sugar comes from a country recognised by the Permanent Commission as giving bounties on the production or exportation of sugar.

"Article 3.—The present Supplementary Act shall be ratified, and the ratifications shall be deposited at the Ministry for Foreign Affairs at Brussels as quickly as possible, and in any case before February 1, 1908. Its provisions shall not become obligatory

* This is a translation from the French and not the official English version. The latter has not been issued up to date.

unless it is ratified by at least all those contracting Powers who do not come under the exceptional terms of Article 6 of the Convention. In case one or more of the said Powers shall have failed to deposit their ratifications within the specified delay, the Belgian Government, during the month beginning February 1, 1908, shall call upon such Powers as have ratified to decide whether the present Supplementary Act shall be applied as between themselves. The States which shall have failed to ratify before the date fixed, viz., February 1, 1908, shall be considered as having denounced the Convention within the prescribed limits for it to cease to bind them from the following September 1, unless a decision has been given in a contrary sense at the request of the Powers in question by a majority of the States summoned to deliberation, as set forth in the preceding paragraph."

In pursuance of which the respective representatives have signed the said Act Supplementary at Brussels, on August 28, 1907.

PROTOCOL OF SIGNATURE.

The following "Protocol of Signature" was also agreed to:—

"It is agreed that if the ratifications necessary according to Article 3 to give validity to the Supplementary Act have not been handed in before March 1, 1908, the British Government shall be at liberty to denounce the Convention at that date from September 1, 1908, whether or not they shall have previously ratified the Supplementary Act."

CENTRAL FACTORIES AND SCIENTIFIC TRAINING IN MAURITIUS.

(*Contributed.*)

With reference to the article that appeared in the July issue of this Journal entitled "Sugar Planting in Mauritius," we would offer a few further remarks on the same subject by way of amplifying the suggestions for the establishment of central factories in that island.

We may preface our remarks by saying that the weight of cane and the quantity and quality of the juice may be considered as the principal factors controlling both the culture of the cane plant and the manufacture of sugar therefrom. It is in this way that information is obtained as to the crops yielded by the various soils, as to the effect of manures and modes of cultivation and as to the varieties of cane which produce the sweetest juice and the largest return; while the factory manager will in his turn have to consider the best way of utilising his machine plant and his processes mechanical and chemical in clarifying and evaporating the juice and curing the product.

Apart from the discipline of the workman (a very important point but one which we do not propose to discuss in this article) in order to secure successful results accuracy of the strictest kind is indispensable in every detail both of cultivation and manufacture down to the packing, and in no manufacture is it more essential than in that of sugar, beginning with the analysis of soils, manures, and stores; the choice of plants best suited to the soil and climate; the draining and fallowing of the ground with offal crops; the regularity of planting and application of manures,* trashing, weeding, &c.; the irrigation (where practicable) down to the cutting and crushing of the cane and the drying of the megass, the last though by no means the least important being the weighing of the cane, upon which will depend much of the correctness of the statistics of the plantation.

We have included crushing in the foregoing enumeration of essential details of cultivation, though in strictness it is the first of the manufacturing processes for the reason that some central factories pay the cane farmers by the weight of the cane delivered, others by the volume of juice produced; but in all cases it is assumed that the crushing is effected at the central factory. In the case of most agricultural products the general course of cultivation ends with the drying or curing of the crop, *e.g.*, cereals, tea, coffee, cocoa, &c., which is then ready for delivery, but in the (almost) solitary example of sugar an elaborate process of manufacture has to be gone through before it is fit for market. One of the greatest advantages of the central factory system is that the sugar planter's responsibility ends with the delivery of the cane at the factory, and he is left at liberty to devote his whole time and capital to the cultivation of his canes and any other bye crops, the culture of which he may see fit to combine with or to alternate with cane.

Enough has already been said to show that efficient field management is in itself sufficient to require the undivided attention of a highly trained cane farmer, and that the cultivation will be much improved by being committed to the care of a specialist. In fact, under the existing system a planter ought to (but does not often) possess the qualifications of a farmer, a factory manager, or engineer, and an analytical and practical chemist—three requisites which cannot in reason be expected to be found combined in one individual.

We have already emphasized the necessity of great accuracy in the cultivation of the plant, but in the treatment of the juice it is not merely important but indispensable to make use of the best scientific methods of the modern chemist. His services involve the analysis of soils, the testing of manures and stores to detect adulteration, the conduct of experiments in the field; superintendence of the various

*The cane farmer will have to be experienced not merely in the selection and application of artificial manures but also in the management of stock upon which he will have to rely for his pen manure which is of equal if not of greater value to an estate than the chemical stimulants of the soil.

mill processes, *e.g.*, clarification and filtering of juice; evaporation by the vacuum pan and triple and quadruple effects, and the careful watching of the formation of crystals and the prevention of false grain; curing by the use of centrifugals; the production of molasses and its reboiling for second and third sugars; the treatment of megass and other fuels, and finally the detection of errors in tares, weights, and scales, calculations, measurements, vessels, apparatus, and in all the before-mentioned operations.

The business of the engineer is also not a light one comprising as it does the purchase, erection, upkeep and working of the mechanical plant, the care of the boilers and the supply of steam to the factory, and often the construction and management of trams, wire railways, and traction engines.

We have entered at some length into the numerous details of the sugar producer's trade with the object of showing that though the separate services of the farmer, the chemist, and the engineer are essential to successful management, yet the union of their various qualifications in full efficiency in one individual is hardly to be expected, and it follows therefore that a division of labour or separation of these three functions must be carried out. Whether the chief command of an estate should be vested in one, and if so, in which of the three is a question chiefly of practical business ability upon which we need not express any opinion, as we are only concerned in working out a case for the separation of the duties of the farmer from those of the factory manager.

It is also clear from the general consensus of expert opinion that the manufacture of sugar must be carried out upon a large scale if it is to succeed against the competition of beet, &c., as the expense of a good modern plant is beyond the means of all but wealthy planters or companies, and the smaller men must necessarily be eliminated. If, however, the poorer planters give up using the old-fashioned and inferior machinery which unfortunately too often is all they can afford to use, confining themselves to cane farming only, there would seem to be no reason why they should be crowded out at all—they would at once be relieved from the expense of even the smallest and simplest plant, and could devote all their time, capital, and energy to cultivation, and as their profits will depend upon the weight of cane or the quantity and quality of juice delivered at the factory it will be their interest to improve—further, the due course of cultivation will no longer be interrupted by the necessity of employing all their available labour at the mills during crop time, and they will also receive the price of the cane much sooner than that of the manufactured article, and will no longer be at the mercy of the merchant who puts the screw upon the small men in order to arrange for a future "corner" in the market.

In a former article in this Journal the establishment of central factories in Mauritius has been advocated, and there is little doubt that it will, if adopted, effect great economy in the amount of scientific labour required—always a scarce article; in the aggregate outlay on management and plant, and in the improvements in the methods of cultivation and processes of manufacture. The Government could hardly be expected to invest State funds in the building of these factories, but they should give their best aid to companies and associations for that purpose, and see that none but those founded on a thoroughly sound basis should be allowed to exist, and they should also supplement their assistance by the introduction of a good system of technical instruction, to be hereafter described. A very good precedent *mutatis mutandis* can be found in the action of the Kingdom of Denmark, which, by introducing scientific instruction into the rural districts, has raised the dairy and stock interest of that country to a state of great prosperity.

It is well known that most of the British tropical colonies have found their scientific staff of considerable use, but owing to the small number of trained chemists and botanists available, the usual business transacted is confined to making analyses, conducting experiments, and giving advice when required.

What is especially desirable for Mauritius is a good scientific department, not necessarily numerous, but selected with care, and composed of chemists, botanists, engineers, and medical men, for the purpose of assisting the State in improving the products of the island, its sanitation, public works, and waste lands, and in superintending technical teaching. An intelligence department, in fact, is what is wanted—some of the material out of which such a department could be created already exists in the shape of engineers who direct the railways and public works, chemists and botanists * who advise the Government, collect statistics, &c., and physicians and surgeons who are responsible for the health of the country. All these officials no doubt each perform their separate duties, but an intelligence department is wanted to combine and regulate their separate work. Sanitation is dependent on the proper execution of drainage; the doctor and the engineer must here work together; water supply for power, irrigation, and use in manufactures, must depend upon the rainfall and the storage thereof, which again to a great extent depends on the due maintenance of forests, for which the engineer working with the botanist is responsible; then the botanist, the chemist, and the engineer are indispensable agents in the cultivation and manufacture of sugar. Such a department need not be large in numbers, the collaboration of the heads of existing departments in the form of a directing committee would probably answer the purpose, the great end being

* The services of an entomologist would also be desirable for the study and extirpation of insect pests.

a union of practical scientific information and effort—in short, not to create unnecessary official posts, but to ensure that two or more departments of the colonial staff are not doing the same work at the same time, nor clashing with each other, and that information is collected and experiments made in the botanic garden and in the laboratory with a view to one object, *i.e.*, the improvement of the colony, its agriculture and its products.

Such a department with its assistance should not be confined only to the encouragement of sugar planting and manufacture, but also to that of the growth of coffee, tea, cocoa, &c., to the planting of timber trees and re-afforestation, and perhaps to the establishment of a rubber industry; whille at the same time the care of railways, roads, water storage, and drainage should not be neglected.

Another important point to which the suggested intelligence department should direct its attention is to the establishment of a good technical school for the preliminary training of candidates for employment both in the scientific departments of the colony and in the service of planters and manufacturers. The value of such a training has been shown (to quote one out of many instances) in the case of the City of Zurich, where the best technical university in Europe has been established many years, and now supplies all the civilized world with botanists, chemists, and engineers, and there is no reason why, if such a school were founded in Mauritius and energetically supported both by the State and the zeal of the students, there should not be a great opening in the East, especially when we remember the proficiency already shewn by the Cernians in the growth and manufacture of sugar, but it must not be forgotten that if such a school is to succeed and perhaps grow into an Eastern technical university, that the instruction given must be severely practical and accurate.

It must be again repeated that energetic encouragement of technical education and of native and imported industries would in a few years greatly increase the prestige, prosperity, and population of the island, and raise up a race of intelligent planters, manufacturers, and scientific men. In conclusion, we are loath to believe that the Mauritians, who still enjoy a high reputation as planters, will allow that reputation to be endangered, but if they wish to preserve it, it is to be done only by strict attention to business and education, and by the adoption of up-to-date methods, and not by clamouring for State assistance in temporary misfortune. What they may fairly ask from the Government is facilities for acquiring knowledge of the best modern education and methods. They themselves must do the rest.

The Board of Trade have stated that the quantities of sugar refined in this country of late years have been as follows:—1904, 11,640,000 cwts.; 1905, 11,617,000 cwts.; 1906, 11,833,000 cwts.

THE B 208 CANE AT PLANTATION DIAMOND.

It will be remembered that on the strength of information supplied us from British Guiana we ventured in our May issue to question the identity of the canes grown at Plantation Diamond, Demerara, under the name of B 208. Our statement raised a storm of indignation both in the press and in private correspondence received by us, while the only calm reply elicited was the one from Mr. Fleming, the manager of the said plantation, who in a letter to a Demerara local paper gave a detailed denial to the charge. His statement was too definite to admit of much question unless some new facts were forthcoming; but we felt that it would be only just to our informant to give him a chance of replying ere we decided that we had been misinformed. Up to the time of going to press for our last number we had not, however, received any further communication from him, due to the fact that he was some four weeks' journey from us, so that the matter has had to be deferred to the present issue. But we have now had several communications from him, of which the following is the latest:—

To the Editor, "The International Sugar Journal."

Sir,—The courteous and well-considered letter of Mr. Fleming appearing in the Demerara *Daily Chronicle* of May 28th, leaves no doubt that the statement I forwarded you regarding the identity of the B 208 cane grown at "Diamond" was incorrect, and I must therefore express my regret at having forwarded you the statement.

It is however a matter of greater regret that the allegation regarding B 208 should have been made in the local West Indian press the handle for an unjustifiable attack on Mr. J. B. Harrison, and on his invaluable work which has been of so great benefit to the cane sugar industry.

I am, etc.,

Your Informant.

Under the circumstances we must ourselves express sincere regret that we had occasion to cast an aspersion on the management of the Diamond Plantation as regards the identity of their canes and incidently also on those scientists who were responsible for supplying the plantation with the original cuttings. But while willingly offering this apology, we cannot leave it to be concluded that our statement was utterly groundless, and that our attack was merely conceived in the interests of personal bias. We must therefore submit to our readers the following facts and leave them to judge for themselves how far we were justified in giving voice—somewhat too uncompromisingly perhaps—to a widespread belief.

The 1905-06 Report of the Board of Agriculture of British Guiana contained some reference to the Plantation Diamond B 208 canes, wherein it was suggested that the cane grown there was possibly different from the so-called B 208 in other parts of the colony. Whether this started the suspicion or not, it is clear that on subsequent occasions, as we are informed, a number of independent planters took the opportunity of inspecting the cane grown at Diamond as B 208 and came to the conclusion that it was totally distinct from that grown elsewhere in the colony under the same name; and some went so far as to identify it with the *White Tanna*. Now the matter was one of no small importance to those concerned. Whatever may have been said in the annual Reports on the merits of this cane, yet in the opinion of many planters who had tried it themselves it was not a sufficient success elsewhere in Demerara as to warrant its continuation save on the strength of the reports from Plantation Diamond. And it is to be observed that even Mr. Fleming himself is not so enamoured of it as to desire to retain it longer than necessary; as soon as he finds a better species he will discard the B 208. When, therefore, the impression spread that the Diamond cane was a different one, much indignation was naturally aroused. That this belief did not get sooner ventilated in the press is no reason for doubting its existence. And that those concerned should have preferred to voice their doubts in an independent journal rather than in their own local press is quite comprehensible. If the general belief in Demerara planting circles regarding the identity of this cane was erroneous, it was as well to obtain an authoritative statement, and it seems undeniable that private attempts to obtain such information had resulted in failure From quite an independent source we learn that more recent attempts to get hold of specimens of the Diamond canes have been unsuccessful; an air of mystery seems to have surrounded all that goes on at the Diamond estate and it is no wonder that those who have most desired definite and independent information should have resorted at length to a statement in the press. We are sorry that we should have published a charge which we now know to be untrue; but at the time it was supplied to us we had what appeared to us sufficient cause for accepting its accuracy, and the very reasons which prevented our correspondents from getting information on their own account would probably have proved an obstacle to us in verifying the matter by private inquiry. As it is, we have been the means of clearing up to some extent a question of no small importance, and we cannot doubt but that some good will result now that the British Guiana planters know definitely to what species the successful Plantation Diamond canes belong.

But what after all does this fiercely debated question amount to? It is concerned solely with the identity of a certain seedling cane. But the knowledge of seedling and other canes is by no means a

complete one, even in the case of the Imperial Department of Agriculture, as has been made apparent to us in the course of this dispute. We had occasion in our July issue to observe that Sir Daniel Morris was under a misapprehension with regard to the colour of the *White Tanna* cane; and we can now further point out, what also is mentioned by the *West India Committee's Circular*, that contrary to the Commissioner's supposition that the *White Tanna* is hardly known outside Mauritius, it is as a matter of fact identical with the *Yellow Caledonia* of Hawaii and the *Malabar* of Fiji. All of which goes to prove that the identity and nomenclature of canes is still in a hopeless state of confusion, and that we are not the only one to be led into making what is subsequently proved to be an erroneous assertion. We must say that having regard to this confusion, we cannot help thinking that an undignified fuss has been made over the matter, and that Mr. Fleming's pertinent reply was far more in keeping with the nature of the dispute than have been the numerous articles appearing in the press as well as the indignant letters we have received from highly-placed persons. As to the abusive leaders appearing in some of the Demerara and Barbados papers on the subject, one can afford to ignore them, knowing as one does the nature of certain organs of the press to be found in that part of the world, and having regard to the fact that the bitter and grossly unfair tone adopted by one of them was presumably dictated by the supposition that our informant was a gentleman on whom that paper has been persistently "down" for some time past.

It will, however, be a matter for congratulation if the ultimate result of all this is to lead to some serious attempt on the part of sugar scientists to place the nomenclature of the sugar cane on some standard basis, so that it shall no longer be possible to find the same cane referred to under three or more different names. It would also be worth while obtaining all the available data as to their colour and characteristics, when grown in different countries, at different altitudes, and on different soils. A big task, doubtless, but none the less necessary.

We would also express the hope that the Plantation Diamond authorities will courteously extend to all genuine enquirers the opportunity to satisfy themselves regarding the characteristics of that estate's B 208 cane, and enable them to ascertain whether these canes are really different from other specimens in the colony and if so, in what respects.

Finally we hope that in future the Demerara planters will show more willingness than they have hitherto done to co-operate in the work of establishing on a firm basis the scientific side of their industry.

REPORT OF THE TARIFF COMMISSION ON SUGAR.

The Tariff Commission, inaugurated by Mr. Chamberlain a few years ago, has recently turned its attention to sugar and confectionery, and its report on the same was issued last month. This comes at a most opportune moment and we hope that the conclusions drawn by the Commissioners will receive due consideration in all quarters. For the present we must content ourselves with a brief summary of the contents, but in our next issue we shall hope to give longer extracts from the report.

Among the main points elucidated in the volume are the following:—

Consumption.—The annual consumption of sugar in the United Kingdom has increased enormously. Fifty years ago it was 29½ lbs. per head of the population; in 1885 it was 79½, and in 1906 was 95¼ lbs. But the British refining industry has not only failed to keep pace with this great increase in consumption but has declined absolutely in the last 20 years. Whereas in 1885 the sugar refined in British factories exceeded 19½ million cwts., it had fallen in 1903 to 12½ million cwts. and in 1906 was 15¼ million cwts.

Foreign Refining.—While the British refining industry has declined the refining industries of Germany, Austria-Hungary, France and other Continental countries have greatly advanced chiefly through the increase of the population and the growth of sugar consumption in the United Kingdom. Fifty years ago practically the whole of the sugar used in the United Kingdom was refined at home; twenty years ago we refined only 70 per cent.; and in 1906 only 45 per cent., the balance being made up by importations of sugar refined in Continental factories. Our importation of refined sugar from Germany is now 12½ million cwts., an increase of 10½ millien cwts. in 20 years.

The increase in the beet-growing area abroad.—Germany's area has nearly trebled within 25 years; Austria's area has more that doubled in 20 years; so has the Belgian area, while that of France has increased by about 10 per cent.

Cane producing countries suffered severely by the competition of the Continental bounty-fed supplies of beet sugar. The importation into the United Kingdom of raw cane sugar from the British West Indies fell from 1,400,000 cwts. in 1885 to 450,000 cwts. in 1903; from British Guiana from 1,300,000 cwts. to 220,000 in the same period and from the British East Indies from 850,000 cwts. in 1885 and 1,600,000 cwts. in 1896 to 286,000 in 1903.

The loss to British refineries owing to this importation of foreign refined into the United Kingdom is estimated to amount to 1½ millions per annum, of which about £375,000 would be spent in wages in the sugar factories.

Bounties.—The unfair character of the foreign competition in the British market is constantly referred to in the evidence, especially as regards the Cartel system and the wholesale dumping it induced.

The Effects of the Brussels Convention.—The Brussels Convention, which came into operation in 1903, abolished State bounties on the cultivation and manufacture of sugar in Germany, Austria, France, Belgium, and other competing countries. In consequence cartels became impossible. It is shown in the evidence that since these changes (*a*) the importations of refined sugar into the United Kingdom have declined, while the importations of raw sugar have increased; (*b*) sugar factories in this country have employed more workmen, and the employment has been more continuous; (*c*) importations of raw sugar from the British West Indies and British Guiana have increased appreciably; (*d*) the exports of British sugar machinery to British cane-growing Colonies, which were declining, have increased largely—it is said by the West India Committee by fully 50 per cent.; (*e*) but for the exceptionally high prices of 1904 the level of prices has remained normal; (*f*) the exports of confectionery have increased 25 per cent. in value from 1903 to 1906, and the exports of mineral waters have increased more than 50 per cent.

Results of Preference.—Two systems of Preference, in the United States and Canada respectively, have had a great effect on the sugar growing and sugar manufacturing industries of the British Empire. (*a*) The United States preference to Cuba and the Philippines deprived the British cane-growing Colonies of their large United States market; (*b*) the Canadian preference and later the Canadian surtax on German sugar helped to divert to Canada the sugar from the British cane-growing Colonies which formerly went to the United States. Under the Canadian preference there has been a fourfold increase in the exports of British refined sugar to Canada, and there has been a five-fold increase since 1900 in the British exports to Canada of confectionery, jams and preserved fruits.

Future Policy.—The evidence, in general, points to the desirability of maintaining the Convention; but it is widely held that the principle of countervailing duties should be adopted in the place of prohibition.

Confectionery manufacturers strongly urge the abolition of the sugar duty which the evidence and statistics show to be the main cause of the rise in price of sugar.

It is the general opinion that the greatest benefit would result to all interests in the British Empire from a system of mutual preference under which the sugar cultivation of the British West Indies, British Guiana, and other parts of the Empire would be increased, the British consumer would be given a larger choice of supply and made less dependent upon foreign sugar, and the markets of the Empire would be secured for its own sugar producers and manufacturers.

COMPOSITION OF EGYPTIAN SOILS AND NILE-OOZE.

By MM. H. Pellet and R. Roche.

During 1906 thirty samples of soil under cane cultivation were taken from different parts of the Nag-Hamadi region of Northern Egypt. The methods of sampling and of analysing those samples were those adopted officially at the French Agricultural Stations, but certain determinations were carried out by special methods proposed by M. H. Pellet.

As six of the samples were of special interest, they were submitted to a more detailed examination than the remainder, and the results are given in the accompanying tables.

The results of this investigation may be stated as follows:—

The soils of this region are very homogeneous in their general composition, and contain from 5 to 7 per cent. of lime, from 20 to 65 per cent. of sand, from 20 to 60 per cent. of clay, and from 0·8 to 1·3 per cent. of humus. The compact nature of most of these soils is significant as influencing the diffusion of fertilizing elements.

As regards chemical composition, the most remarkable feature is the high percentage of magnesia (from 1 to 3 per cent.), which is rarely met with in arable land; and of manganese (from 0·05 to 0·02 per cent.). The more important fertilizing elements were present in the following proportions *per kilogram of soil*:—

	Minimum.	Maximum.	Mean.
Phosphoric Acid	1·44	2·30	1·75
Potash	1·56	3·68	2·28
Organic Nitrogen	0·37	1·40	0·72
Nitric Nitrogen	0·00	0·04	0·004

The soil ingredients which were soluble in water varied from 0·04 to 0·12 per cent. (or even more), and consisted mainly of the carbonates and sulphates of lime and magnesia in the soils which were not efflorescent; or of nitrates of soda and potash in the alkaline soils.

Finally, the following proportions of chlorine and sulphuric acid, (which have so much influence on the formation of efflorescent salts, detrimental to plant life) were found in the more fertile soils:—

Chlorine	0·10 to 0·060 per kilogram.
Sulphuric Acid	0·25 to 1·60 ,,

The full significance of these analyses cannot of course, be drawn from a hasty review of the results obtained, either collectively or in each particular case. In order to gain all the information that is possible the analytical results must be studied in the light of other

information, more especially the mode of cultivation to which the soil has been previously subjected. This we have attempted in the case of each of the above-mentioned soils, but lack of space prevents us from enlarging on this very interesting part of our study of Egyptian soils.

The present occasion appears a favourable one for collecting together the various analyses of Egyptian soils made during the past 40 years, and uniting them in one table, as under:—

Mean Composition of Egyptian Soils.

Resumé of Analyses by different Chemists since 1870.

	Payen, Champion, and H. Pellet.	Gastinel, Bey.	H. Pellet, Delamare, Arnaud, and Klein.	Ch. Pensa.	Mackenzie and Burns.	H. Pellet and R. Roche.
Numbers	1	2	3	4	5	6
Date of Analyses	1871	1881	1895 & 1903	.	1905	1906
Number of Sample	20	22	30	..	7	28
Density (actual)	..	..	..	..	..	2·23
Density (apparent)	..	..	..	..	..	1·15
Moisture, per cent..	..	..	..	..	..	6·30
Lime	..	..	5·70	3·10	..	6·40
Sand..	..	..	..	..	..	45·80
Clay	..	..	31·00	..	..	36·40
Humus	..	..	..	..	..	1·17
Phosphoric Acid, per kilo..	2·47	5·40	1·94	2·38	2·46	1·75
Potash	..	..	2·08	4·09	6·15	2·28
Organic Nitrogen	0·58	2·01	1·28	0·61	0·82	0·72
Nitric Nitrogen	..	..	..	..	0·018	0·004
Lime, per cent.	..	..	2·60	..	4·18	2·49
Magnesia	..	..	1·84	..	2·70	2·87
Iron and Alumnia..	..	..	28·90*	..	22·15*	10·52
Manganese	..	..	..	..	0·26	0·084
Sulphuric Acid..	..	..	0·05	..	..	0·073
Chlorine (Cl)..	..	..	..	..	0·064	0·005
Soluble in Water, per kilo.	..	..	..	..	..	0·56

* Complete extraction with acid.

Analyses of Soils of the Nag-Hamadi Region.

Results are expressed as parts per 100 of dry soil, unless otherwise indicated.	Dahassa.		Semaxhore.			Experimental Field.
	Bad.	Good.	Good.	Average.	Bad.	
Sample No.....	1	2	3	4	5	6
Density (actual)	2·32	2·17	2·27	2·17	2·22	2·22
Density (apparent)	1·25	1·11	1·10	1·06	1·19	1·06
Moisture	7·90	6·56	6·70	5·12	7·60	4·40
Lime	6·02	6·50	5·74	6·82	6·30	7·02
Sand	38·60	50·00	46·60	49·96	24·30	65·80
Clay	46·50	35·00	39·80	37·10	60·70	21·70
Humus	1·06	1·10	1·20	1·12	1·19	1·10
Physical character..	heavy	light	rather heavy	rather heavy	very heavy	light
Fertilizing Elements soluble in Nitric Acid (per kilogram of soil) :—						
Phosphoric Acid, P_2O_5.. ..	1·48	2·23	1·67	1·84	1·52	2·14
Potash, K_2O	1·71	2·56	2·01	2·51	1·91	2·22
Organic Nitrogen, N	0·53	0·61	0·65	0·81	0·51	1·06
Nitric Nitrogen, N	0·00	0·031	0·006	0·00	0·00	0·007
Total	3·72	5·43	4·33	5·16	3·94	5·42
Reputation of the field	bad	good	good	medium	bad	medium
Lime, CaO	2·24	2·18	2·35	2·59	2·71	2·89
Magnesia, MgO	2·94	2·88	3·12	2·59	2·84	2·85
Iron and Alumnia	11·53	10·66	10·46	10·76	10·68	9·06
Manganese, MnO	0·137	0·086	0·083	0·063	0·071	0·067
Sulphuric Acid, SO_3	0·031	0·035	0·088	0·072	0·069	0·061
Chlorine, Cl..	0·006	0·004	0·005	0·005	0·005	0·006
Soluble in Water (per kilogram of soil)	0·71	0·50	0·53	0·58	0·50	1·26
Containing :—						
Carbonate of Lime, $CaCO_3$ ..	0·140	0·020	0·090	0·120	0·090	0·070
Sulphate of Lime, $CaSO_4$ ...	0·110	0·120	0·150	0·120	0·100	0·400
Chloride of Magnesia, $MgCl_2$..	0·110	0·060	0·090	0·080	0·090	0·130
Carbonate ,, $MgCO_3$..	0·240	0·140	0·130	0·170	0·120	0·200
Sulphate ,, $MgSO_4$..	..	..	..	..	..	0·120
Potash, K_2O	..	..	..	..	..	..
Soda, Na_2O	..	..	..	..	..	..
Nitrate of Lime, $Ca(NO_3)_2$..	0·00	0·174	0·035	0·00	0·00	0·038

ANALYSES OF SOILS OF THE NAG-HAMADI REGION.

Mean.	Bakhanes.		Sagati.		Biha.	Bir-el-Nousf.		
	West.	East.	West.	East.		Good.	Bad.	To depth of 4 meters.
	7	8	9	10	11	12	13	14
2·23	..	..	..	..	..	..	..	..
1·13	1·09	1·16	1·16	1·19	1·16	1·19	1·16	1·31
6·38	..	..	..	..	..	..	..	..
6·40	..	..	..	..	..	..	..	..
45·88	..	..	..	..	..	..	..	..
40·28	40·0	52·6	20·0	21·0	21·0	37·9	40·0	63·1
1·13	1·47	1·47	1·05	0·84	0·94	0·95	1·15	0·92
..	rather heavy	heavy	very light	very light	very light	light	rather heavy	very heavy
1·81	1·85	2·02	1·63	1·61	1·66	1·50	1·45	1·44
2·15	2·22	2·47	1·66	1·86	2·12	1·66	1·62	1·56
0·69	0·84	0·69	0·66	0·59	0·73	0·62	0·55	0·37
0·015	0·005	0·003	0·006	0·040	0·003	0·003	0·010	0·002
4·66	4·91	5·09	3·95	4·10	4·51	3·78	3·63	3·37
..	good	good	good	good	good	medium	bad	subsoil
2·49	..	..	..	..	..	..	..	..
2·87	..	..	.	..	.	.	..	..
10·52	..		..	..	..	..	..	..
0·084	..	..	..	..	..	..	..	..
0·073	..	..	..	..	..	..	..	..
0·005	..	..	..	..	..	..	..	..
0·68	0·54	0·42	0·46	0·71	0·44	0·50	0·42	1·26
0·088								
0·167								
0·093								
0·167								
0·120								
0·020								
0·064								
0·041								

ANALYSES OF SOILS OF THE NAG-HAMADI REGION.—*Continued.*

	Garden Soil of good quality.	ASSIRAT.			NAG-EL-GADI.	
		A.	B.	C.	North.	South.
Sample No....	15	16	17	18	19	20
Density (actual)	..	..	..	..	..	..
Density (apparent)	..	..	..	..	..	..
Moisture	..	..	..	..	..	..
Lime	..	..	..	..	..	..
Sand	..	..	..	..	..	..
Clay..	21·0	38·9	51·5	38·9	21·0	56·8
Humus	1·26	0·89	1·31	1·26	1·36	1·30
Physical Character	very light	rather heavy	heavy	rather heavy	very light	very heavy
Fertilizing Elements soluble in Nitric Acid (per kilogram of soil):—						
Phosphoric Acid, P_2O_5 .	1·67	1·53	1·47	1·51	2·06	1·65
Potash, K_2O	1·91	1·75	1·75	1·70	3·02	3·12
Organic Nitrogen, N	0·66	0·51	0·95	0·51	1·40	1·00
Nitric Nitrogen, N	0·006	0·001	0·003	0·004	0·005	0·002
Total	4·24	3·79	4·17	3·72	6·48	5·77
Reputation of the field	good	medium	medium	medium	excellent.	excellent.
Lime, CaO	..	..	..	..	..	..
Magnesia, MgO..	..	..	..	..	..	..
Iron and Alumina	..	..	..	..	..	..
Manganese, MnO	..	..	..	..	..	..
Sulphuric Acid, SO_3	..	..	..	..	..	..
Chlorine, Cl	0·003	0·005	0·005	0·003	0·001	0·002
Soluble in Water (per kilogram of soil)	0·71	0·63	0·63	0·42	0·50	0·44

ANALYSES OF SOILS OF THE NAG-HAMADI REGION.—*Continued.*

ABOU-SAFIA.	NOUVEAU SEMA-PHORE.	Garden Soil.	Garden Soil.	RAILWAY FIELD.		ROUSSAS.		Mean of 28 Samples.
				Good.	Average.	Good	Bad.	
21	22	23	24	25	26	27	28	
..	..	..	..	..	..	..	..	2·23
..	..	..	..	..	..	..	..	1·15
..	..	..	..	..	..	..	..	6·31
..	..	..	..	..	..	..	..	6·40
..	..	..	..	..	..	..	..	45·80
48·9	23·1	21·0	21·0	38·9	23·1	38·9	37·9	36·40
1·10	1·10	1·40	1·35	1·30	1·30	1·10	1·20	1·17
heavy	light	very light	very light	rather heavy	light	rather heavy	rather heavy	
1·95	1·53	1·62	1·65	1·93	2·20	1·92	2·30	1·75
1·96	2·67	2·32	2·42	2·98	3·61	2·78	3·68	2·28
0·80	0·72	0·70	0·66	0·82	0·90	0·64	0·60	0·72
0·004	0·007	0·020	0·005	0·003	0·004	0·004	0·005	0·004
4·71	4·92	4·64	4·73	5·73	6·71	5·34	6·58	4·75
excel-lent.	good	good	good	excel-lent.	excel-lent.	good	good	
..	..	..	..	..	..	..	..	2·49
..	..	..	..	..	..	..	..	2·87
..	..	..	..	..	..	..	..	10·52
..	..	..	..	..	..	..	..	0·084
..	..	..	..	..	..	..	..	0·073
..	..	..	..	..	..	..	..	0·005
..	..	..	..	..	..	..	..	0·56

In the above table we have re-calculated certain figures in order that all the analysis might be expressed in parts per 100 of dry soil. We may remark, however, that owing to different analytical methods having been employed, the above analysis are not strictly comparable. Thus, the variation in certain constituents—potash, for example—which appear excessive at first sight, are sufficiently accounted for by a detailed examination. The various analysis indicate that what we have stated above as applicable to the region of Nag-Hamadi, applies more or less to the whole of Egypt; in other words, that the soils of Egypt are very uniform in their general composition. They are rich in potash, a little less so in phosphoric acid, and somewhat deficient in nitrogen. Magnesia is present in notable quantities, as also is manganese.

On the other hand, the physical constitution of Egyptian soil varies according to the locality, and even in the same field, owing to the variable percentage of clay (namely, from 20 to 60 per cent.). The clay and sand, being derived from the same primitive rocks, are very similar in chemical composition; the former being merely in a more advanced stage of disintegration. This similarity in composition is shown by the following analyses: —

Analysis by H. Pellet, 1895.

	Mean of 30 samples.		
	Sand.		Clay.
Lime	25·20	....	28·20
Magnesia	16·60	....	19·00
Phosphoric Acid	1·87	....	2·10
Potash	2·30	....	2·00
Nitrogen	1·67	....	0·80

Notes on Analytical Methods Employed.

1. *Humus.*—Determinal by Schloesing's method, *i.e.*, separation and weighing.

2. *Physical character.*—This expresses the relative compactness of the samples as influenced by their percentages of clay.

3. *Clay.*—This was determined by Schoesing's method in samples 1 to 6; and by Pagnoul's optical method in samples 7 to 28.

4. *Fertilizing elements* (Soluble in Nitric Acid).—50 grams of soil were exactly neutralized with dilute nitric acid, and then treated with a mixture of 50 cc. nitric acid (sp. gr. 1·42) and 200 cc. of water for one hour over a water-bath. The volume was finally diluted to 500 cc., making an allowance for the volume of the insoluble residue.

In order to render the differences more appreciable the results are expressed in parts per 1000.

5. *Soluble in Water.*—The soluble matters are washed out with distilled water. The results are expressed as certain salts, but other combinations might be deduced from the same analytical data.

6. *Organic Nitrogen.*—Determinal by combustion with soda lime.

7. *Nitric Nitrogen.*—Determinal colorimetrically by means of phenol-sulphuric acid.

8. *Reputation of the field.*—Opinions expressed by the planter.

The Nile-ooze.

This has long been regarded as a kind of manure which renders the soils of Egypt very fertile. Recent analyses having shown, however, that the chemical composition of the Nile-ooze is exactly the same as that of the low-lying soils, the logical conclusion is that these soils have been formed from the accumulated deposits of the ooze.

The following analyses by MM. Mackenzie and Burns (1st Year Book of the Khedivial Agricultural Society) and ourselves, which only differ as regards the methods of analysis, are each strictly comparable to the analyses of soils given above :—

	Mackenzie and Burns, 1899.	H. Pellet and P. Roche, 1906.
Lime, per cent.	3·07	2·10
Magnesia ,, ...	2·68	2·08
Iron and Alumina, per cent.	22·56	10·50
Manganese ,, ..	0·25	0·09
Phosphoric Acid ,, ..	2·50	1·18
Potash ,, ..	5·30	1·15
Organic Nitrogen ,, ..	1·45	0·93

(*Bulletin des Chimistes.*)

THE SOLUBILITY OF SUGAR IN THE PRESENCE OF CANE NOT-SUGAR.

An important table, illustrating the influence of impurities derived from the cane on the solubility of sugar, appeared in *The Sugar Cane*, 1897, page 635, and in Mr. H. C. Prinsen Geerligs' work, "On Cane Sugar and the Process of its Manufacture in Java," page 79 (of the second edition). It contained a number of errors which may have puzzled readers, and, in consequence, we now reprint it, thoroughly revised by the author himself.

TEMPERATURE 28° C. SYRUP FILTERED IN LABORATORY.

No.	Dry Substance.	Sucrose.	Glucose.	Ash.	Water.	Quotient.	Glucose / Ash.	Sucrose ×100 / Water.	
0	..	..	..	..	..	100	..	216·2	
1	83·55	47·90	17·44	7·00	16·45	57·33	2·49	291·2	
2	82·88	47·80	14·53	6·66	17·12	57·67	2·18	279·2	
3	82·90	43·70	15·80	6·50	17·10	52·71	2·43	255·6	Over normal.
4	74·88	59·20	7·29	6·07	25·12	79·06	1·20	235·7	
5	74·29	58·70	9·97	3·82	25·71	79·01	2·61	228·3	
6	74·69	50·20	15·14	4·35	25·31	67·21	3·48	198·3	
7	80·90	35·30	27·60	8·08	19·10	43·63	3·42	184·8	
8	72·23	49·00	16·52	2·52	27·77	67·84	6·56	176·4	
9	76·80	36·90	26·30	4·97	23·20	48·05	5·29	159·1	
10	77·02	33·80	28·20	6·88	22·98	43·88	4·10	147·1	
11	71·55	43·10	20·87	3·39	28·45	60·24	6·16	151·5	
12	77·10	34·10	23·00	7·80	22·90	44·23	2·95	148·9	
13	71·07	42·90	19·93	3·00	28·93	60·36	6·64	148·3	
14	75·50	33·70	28·12	3·65	24·50	44·64	7·70	137·6	
15	74·62	34·05	27·78	4·16	25·38	45·63	6·68	134·2	
16	82·00	23·94	40·00	5·30	18·00	29·20	7·55	133·0	
17	75·86	30·90	27·47	6·37	24·14	40·73	4·31	128·0	Solubility under normal.
18	73·78	32·19	30·30	3·77	26·22	43·63	8·04	122·8	
19	73·88	32·90	27·53	3·72	26·12	44·53	7·40	126·0	
20	76·20	29·70	32·40	5·79	23·80	38·98	5·60	124·8	
21	74·99	30·34	28·57	4·02	25·01	40·46	7·11	121·3	
22	74·23	30·69	31·73	3·65	25·77	41·34	8·69	119·1	
23	75·94	28·50	32·81	4·52	24·06	37·53	7·26	118·5	
24	75·56	28·12	31·82	4·64	24·44	37·22	6·86	115·1	
25	71·40	32·40	23·00	5·20	28·60	45·38	4·42	113·3	
26	74·42	27·01	37·46	3·09	25·58	36·29	12·12	105·6	
27	72·00	27·20	30·00	5·00	28·00	37·78	6·00	97·1	
28	73·93	22·42	34·50	3·30	26·07	30·33	10·45	86·0	

H. C. PRINSEN GEERLIGS.

Pekalongan, July, 1907.

SOME DIFFICULTIES IN SUGAR CANE EXPERIMENTS.

By Albert Howard, M.A., F.L.S., Imperial Economic Botanist to the Agricultural Department, India.

The difficulties of carrying out all field experiments are well known. With ordinary crops, like the cereals for example, in which the produce of seed and straw can be weighed without much trouble, fairly reliable results can be obtained, provided all due care is taken. In the case of sugar cane, however, the matter is by no means so simple. Here the crop must be passed through the mill and the juice must be manufactured into sugar before the results of an experiment can be known. It is proposed in the present note to draw attention to some of the difficulties which beset those concerned with field experiments designed for the improvement of the sugar cane.

One of the first difficulties encountered is the sampling of a plot of sugar canes, especially where numerous small plots have to be dealt with. It is not always possible to reap and turn each plot into sugar separately. The usual practice in such cases is the following:—The plot is cut, the total weight of canes determined and a sample (say 100 lbs.) is selected by some mechanical method and crushed in a small mill. The juice is then analysed with the polariscope. A calculation is now made, by which the result is given in tons of sugar per acre. This method is not without its disadvantages, as will be evident when it is remembered that the weight of canes per acre is anything between 20,000 and 100,000 lbs. Any error, therefore, in selecting a sample of 100lbs. will be multiplied by a factor varying from 200 to 1,000, when the results are expressed in tons of sugar per acre.

That unreliable and misleading results are obtained when canes are grown in small plots, and when the produce has not been made into sugar, has been clearly proved by Harrison* in British Guiana, who states: "No trustworthy way has yet been found to get the returns of plot experiments to conform with the results of field cultivation. We have often had results from plots that were simply astonishing. On paper a cane might yield six tons to the acre and yet we know well that tried on a larger scale the yield would only be about 1½ tons. Apart from the tonnage of canes, there are many points that can only be settled by experiments on a large scale. The defective milling qualities and the deficiency of megass of some varieties cannot be discovered on small plots. For decision as to the economic value of a new variety of sugar cane, it is essential that results be recorded as on canes grown on estates' scale and treated under factory conditions. We have in British Guiana at the present time (1902) 27,000 acres under strict chemical control as perfect as exists in any part of the world. At all the plantations, experiments with seedling and other

* Harrison.—"Sugar cane experiments at British Guiana."—*International Sugar Journal*, Volume V., page 178, 1903.

varieties are being carried on as a continuation of the experiments with varieties begun in small plots in the Botanic gardens, and, after careful selection, gradually extended to larger areas." It is interesting to compare the results calculated from the juice of small samples of the plots grown at the Botanical Gardens, British Guiana, with those obtained where the varieties were planted on a large scale on the estates and actually made into sugar. Some of these results are given in the following table:—

Number of Cane ..	625		145		B 147	
	Estates.	Botanical Gardens.	Estates.	Botanical Gardens.	Estates.	Botanical Gardens.
Tons of sucrose in the juice per acré	3·50	5·65	2·48	4·94	2·40	5·64

Number of Cane . ..	78		74	
	Estates.	Botanical Gardens.	Estates.	Botanical Gardens.
Tons of sucrose in the juice per acre.	1·70	2·62	2·48	4·23

It will be seen from these figures that the results calculated from samples taken from the small plots are in many cases nearly twice those obtained from large plots where the canes were actually made into sugar. It is clear, therefore, that before a new cane can be recommended to the cultivators or to planters, trials on a fairly large scale must be undertaken and the crop must be manufactured into sugar.

There must be some reason why a sample from a plot does not actually represent the crop of canes. *Do the individual plants of the same variety vary as sugar producers and do the canes of each stool vary in the same manner?* If they do, then we have at once one reason why a sample gives such misleading results. The recent researches of Kobus* in Java have shown that there is considerable variation in the same variety of sugar cane. It was found that well developed canes of equal age from the same plant show great differences in sugar content, *e.g.*

	Sugar-content per cent.
Mother stalk	9·2
Principal side shoot	13·5
Ditto	12·1
Ditto	6·9

* *Kobus.*—"The chemical selection of the sugar cane."—*International Sugar Journal*, Volume VIII., page 299, 1906. (The detailed papers dealing with the work have appeared in the Java *Archief* since 1898).

Further, individual plants of the same variety were found to vary widely in sugar-content. In some cases these differences amounted to as much as 20 per cent. In view of the variation which is possible in a plot of canes both between individual plants and also between the canes of each stool, it is clear that no reliable results can be obtained if everything is based on the composition of the juice of a small sample such as 100 lbs.

A second difficulty encountered in sugar cane work is to determine the proper time to reap the plots; in other words, to say when the cane is ripe and at its best. This difficulty applies not only to experiments with one variety, but also to a greater extent when several kinds of canes are tried one against the other. In manurial experiments, for example, it would be quite possible to find that nitrogenous manures delayed ripening to an appreciable extent. In such a case unless all the plots were cut and ground at their best, it is easy to see that the error due to cutting too early or too late might be greater than the differences due to the manurial treatment. Where varieties are grown one against the other, it is most necessary that all the kinds should be cut when they are first ripe, for otherwise it will be impossible to say that one variety is better than another. It is possible that the contradictory results sometimes obtained in variety trials in different years may be due to the difficulty in knowing when the cane is ripe. Since Went's investigations in Java in 1896†, I have been unable to find any more recent work on the changes in the composition of the cane before and after ripeness. Went found that at the period when the cane is ripe, the amount of sucrose is at its maximum, while the quantity of glucose is least. After this period is past, inversion takes place, the sucrose decreasing and the glucose increasing. The purity of overripe canes, therefore, falls. From the point of view of sugar making, unripe and overripe canes are alike bad. Went also showed that inversion and loss of sugar take place when aërial roots develop at the upper nodes and when the side buds grow out before the crop is ripe. Such varieties are, therefore, to be avoided as likely to yield an impure juice.

It is not easy to see how to overcome the possible error due to the difficulty of knowing when the cane is ripe. One obvious method of obtaining a more accurate result would be to cut the plots a third or a fourth part at a time. In this way it would be possible to see how long the canes remain at their best, and also to see what kind of error creeps into the result through the difficulty of knowing when the crop is ripe.

Another minor difficulty in experimenting with sugar cane, and indeed with all crops in India, is the question of keeping the varieties pure and preventing admixture. It seems to be the exception in

† *Went.*—"Onder Zœkingen omtrent de chemische physiolojei van het Suikerriet."—*Archief voor de Java Suikerindustaie.* 4th Jaorqang, 1906, S. 525.

India to find any crop of one variety only; mixture of types is the rule. In experiments where varieties are grown next to each other, it is often very difficult at cutting time to be sure that some mixture does not occur at the line of junction of the plots. To avoid this, the plots might be separated by a row of canes of a different colour or by a row of some striped variety. Such a method seems better than to separate the plots by open spaces, as this introduces the error of end plants.

It is naturally far easier to point out possible errors than to devise means for overcoming them. At the same time nothing is gained by carrying out experiments in the field in which fundamental errors are apparent. Workers on the improvement of the sugar cane in India must have the means at hand of getting their canes cut and made into sugar without delay. This naturally involves much time, trouble and expense. But if work is to be done in India of the same high class as that which has been done in Java for many years past, the workers in India must be provided with facilities such as are to be found there. Whether the sugar cane industry in India would justify such an outlay is another question.—(From *Proceedings of the Board of Agriculture in India*, 1907.)

SOME CONSIDERATIONS GOVERNING THE DESIGN OF MULTIPLE EFFECTS.*

(Continued from page 391.)

Circulation of Steam and Removal of Condensed Water.—Horizontal effects have a rapid circulation of steam as the steam is on the inside of tubes, whereas the vertical effects have a slow movement, especially if there is only one vapour entrance. In the latter case the steam has its maximum velocity at the entrance and gradually decreases to nothing at the opposite side of the vessel.

To facilitate the entrance of the steam it is customary to leave out a few tubes near the entrance, and this will prevent, to some extent, the formation of dead spaces. Some builders introduce their vapour pipes in four or eight branches in order to avoid this objectionable feature. The vertical effect is favourable to the removal of the condensed water as it naturally falls rapidly down the vertical tubes.

The velocity of the steam in the horizontal effects may be made very great by making the tubes small in diameter. Most makers follow this practice, an example of which is the Wellner-Jelinek in which the tubes are ¾ inches outside diameter. On the other hand, the removal of the condensed water in the horizontal effect is slow,

*A paper by E. W. Kerr, Professor of Mechanical Engineering, Louisiana State University, read before the Louisiana Sugar Planters' Association, June 13th, 1907.

as it must fall from one tube to another on its way downward. Improvement is therefore desirable in the steam circulation of standard effects and in the water circulation of horizontal effects.

Vacuum.—Calculations show that high vacuum is very essential to high efficiency of the heating surface. In evaporation as in steam turbine work the rate of efficiency increase is greater as the amount of vacuum increases, for instance, a change from 25 to 27 inches of vacuum will increase the efficiency of the heating surface more than 25 per cent. In the opinion of the writer there is too little appreciation of the importance of the last few inches of mercury which are the greatest savers of coal. For this reason the condensers and vacuum pumps should be given the very best of attention and made to perform their very best duty.

Entrainment.—It is probable that there is no loss in evaporation so great as that caused by entrainment, and it seems to be the hardest problem to solve. It varies in amount depending most upon the violence of boiling and the mechanical construction of the evaporator. Besides the sugar loss, which sometimes amounts to as much as 10 per cent., entrainment also causes trouble in the boilers when the condensed vapour is used for boiler feed. In this case the sugar in the water may develop into scale on the heating surfaces, this in turn causing overheating and serious danger of exploding. In addition to this, chemical reactions sometimes result, at low temperatures, which injure the metal of the boiler.

The different means that have been developed for preventing or reducing entrainment may be included in three classes, viz.—(1) mechanical contrivances for separating the particles of liquid from the vapour on the way from one effect to another; (2) increasing the vertical distance from the juice level to exit vapour pipe; and (3) in increasing the area of the boiling surface or, as it is commonly called, the disengagement area.

The larger number of arrangements for this purpose belong to the first class, in all of which the separation is effected by abruptly changing the direction of the vapour by means of baffle plates or similar devices, by decreasing the velocity and temperature of the vapour, by causing the vapour to move in a long circuitous route, or by combinations of two or more of these principles. These will be recognized as similar in principle to the separators used on steam and exhaust pipes of steam engines for catching water of condensation and oil. In many of these contrivances the liquid is separated from the vapour at the expense of a material increase in the loss of pressure due to friction and few, if any of them, entirely prevent this loss. It is therefore probable that the most effective results are to be found in properly proportioning the height of the effect so as to give the particles of liquid time to separate while the velocity of the vapour is relatively small. As is well known, the steam is taken off from domes and drums

in steam boilers for the same reason. The increased height of the effec will, of course, cause a material increase in the first cost of the installation, but there is no doubt that it will be a paying investment.

To discuss this method it will be best to do so in connection with the third method mentioned, that is, the amount of disengagement area. It may be laid down as a principle that for a given quantity of evaporation, the larger the disengagement area, the less the entrainment. This is explained in the fact that the larger the area of boiling the less violent it will be. It will be seen at once that the vertical effect has a relatively small disengagement area and the consequent violent boiling causes an upheaval of liquid with a corresponding necessity for efficient means of preventing the final loss of the same. It will be evident also that the need of relatively great height in the vertical effect is urgent.

On the other hand the disengagement area may be, and is usually, much larger in the horizontal effect, and this accounts for its small loss by entrainment. The first multiple effect built by Rillieux had the circular form practically the same as that of the steam boiler of that time. This form, however, caused considerable loss by entrainment, because of the gradually decreasing cross-section of the space immediately above the juice level, and this, in turn, causing an increased velocity of the vapour just at the time when there was need for the smallest velocity. To remedy this, the latter machines were made of the rectangular form used at the present. This allows the vapour to ascend some distance before the velocity begins to increase, and allows the weight of the drops to overcome the carrying effect of the slowly moving current. For the reasons explained, it is not usual to use the mechanical "juice catchers" on horizontal machines, though they are nearly always used on standard effects. The horizontal effects are usually provided with large drums at the top for this purpose, as in many boilers.

The ratio of height to diameter in the standard effect varies, though it seems to be, in most cases, something more than two. This means that for small effects there is less height from juice level to discharge, and therefore greater entrainment in small vessels. It seems, however, that they should be nearer the same, and experience indicates that this distance should be at least 15 feet. The Lillie and Yaryan types of film evaporators, by reason of the small amount of liquid and low boiling pressure, tend to diminish the entrainment. The Kestner "climbing film" machine on the other hand, has, as already stated, an exceedingly violent boiling. The very long tubes tend to arrest the liquid and that which is carried above the tubes is projected into a set of stationary baffle plates so arranged as to give the suspended liquid a rotary motion, the centrifugal effect of which is to throw it to the walls of the vessel from whence it is returned to the vessel from which it came in the usual manner.

Capacity and Efficiency.—The evaporator is affected largely by all parts of the sugar house, and its economy of operation is of first importance as the fuel consumption is affected to a greater extent here than at any other point. As has been stated, great improvements have already been made, yet there is hardly a doubt but what the demands for better fuel economy, induced by the gradually increasing expenses of machinery, labour, and the competition with the beet industry, will bring forth yet greater improvements. During the last 100 years the steam consumption of steam engines has been changed approximately from 50 to 10 pounds of steam per hour per horse power, and it is agreed that it has now practically reached its best development in this respect. This, however, is hardly the case with the evaporator with which "pounds of steam per gallon of juice" and "gallons of juice per square foot of heating surface per 24 hours" are expressions of efficiency and capacity respectively. The first has to do, primarily, with the fuel consumption, the latter with the first cost of the apparatus, and it may be stated appropriately here that a maximum of the one does not necessarily go with a minimum of the other, although we have the authority of Mr. Noel Deerr to the effect that "the larger the heating surface the less is the efficiency of heat transmission." This shows that as a general proposition the same conditions which induce a large evaporation per square foot of heating surface will cause the best use of the heat in the steam, and therefore a small steam consumption. Upon this basis the fuel consumption should be least when the apparatus is being forced.

The proper amount of heating surface to perform a required amount of evaporation varies greatly with different conditions, and its circulation is difficult, because these conditions are hard to predict. For this reason the many formulas based on theory and requiring a coefficient of heat transmission, determined by experiment or from practice, are not satisfactory. These formulas, however, are of value in making comparisons, even though they may not be satisfactory for the exact determination of heating surface. Experience has shown that with tubes from 3 to 3½ feet in length, a double effect evaporates from 7 to 9, a triple effect from 5 to 7, and a quadruple effect from 3 to 5 pounds of water per square foot of heating surface per hour with steam at 5 pounds per square inch. In a paper before this body in April, 1905, Professor Blouin gave a table compiled from answers to an inquiry sent to Louisiana sugar houses. These replies were all concerning double effects, and the evaporation varied from 4·6 to 11·9 gallons per 24 hours per square foot of heating surface. A Wellner-Jelinek double effect presumably gave an evaporation of 11·9 gallons per square foot of heating surface per 24 hours. These figures are approximate, as the concentration was not the same in all cases.

The amount of water which must be evaporated per ton of cane depends upon the fibre content of the cane, the crushing efficiency of

the mill, the use or disuse of maceration and the amount of it, also the amount of water which is added in clarification. It also depends upon whether the mill or diffusion processes are used. The fibre in the cane may vary roughly from 8 to 16 per cent., and with different efficiencies of crushing, the quantity of juice obtained may vary roughly from 50 to 80 per cent. of the original weight of cane. The maceration water may vary in weight from 5 to 35 per cent. on weight of cane, depending upon the amount of it. The diffusion process results in a dilution of the juice nearly as great as due to the most elaborate systems of maceration. This is necessary even with the poorest of canes. It is therefore evident that with different combinations of these several conditions great variations of capacity will be called for in an evaporator for a required tonnage. The designer will therefore have to design for the maximum possible emergency if he guarantees his machine in terms of tons of cane.

Data upon the amount of steam required to evaporate a gallon of water are difficult to obtain, as the steam is usually exhausted from engines and is therefore not easily measured. Theoretically, one pound of steam is supposed to cause the evaporation of a pound of water in each effect. This, however, is only approximately true. A recent number of the Journal of the French Association of Chemists reports the performance of triple, quadruple, quintuple, and sextuple effects as follows: Triple, ·91 pounds of water per pound of steam; quadruple, ·84; quintuple, ·90; and the sextuple, ·84. These results have been calculated from the report which gave pounds of water evaporated per pound of coal on a basis of 9 pounds of steam per pound of coal.

Finally it may be stated that simplicity and accessibility of parts which have to be cleaned, as in all machines, are important and redeeming features of evaporators. Such are the characteristics of the standard and horizontal effects, and this accounts for their popularity in the face of machines with better fuel economy, but which are less simple in design and operation.

Again, no matter what the excellence of design, good economy can only be obtained at the expense of the very best of careful operations.—*(Louisiana Planter)*.

We have received a copy of a new catalogue describing and illustrating the multiple effet evaporators manufactured by the Mirrlees Watson Co., Ltd., Glasgow. It is tastefully got up, and contains a number of tables to aid intending purchasers to formulate their requirements.

INFLUENCE OF SUGAR ON MUSCULAR WORK.

On many previous occasions we have discussed the influence of sugar on muscular work. Our attention was attracted to the interesting monograph on this subject that was read at the Liège International Congress. Without doubt sugar plays a most important rôle. Evidently one cannot live entirely on sugar, as it is not a complete aliment. Each category of substances, albuminoids, carbon hydrates, and fats have special rôles to fulfil, but sugar permits our muscles to accomplish the greatest amount of work.

Chauveau's laboratory experiments demonstrated beyond cavil that muscles, when working, are fed mainly by carbon hydrates contained either in the blood or in the muscle itself. Glucose is the aliment that furnishes through its combustion the muscular strength. The main object of the albuminoids is for repairing the wear and tear of our tissues, while sugar may be compared with carbon burning in an engine, producing heat and motion; but the boiler itself wears, and effort should be made for its repair. The albuminoids help in the work while the true source of energy is sugar.

Mosso, the well-known Turin (Italy) physiologist, in order to estimate the force obtainable through sugar consumption, uses an ergograph. The strength of a finger of the hand is increased by raising a 3 to 5 kilos weight, depending upon the person, and the record is given in kilogrammeter of the work accomplished; the instrument in question offering special advantages over the hitherto elliptical dynamometer, giving the strength in kilos. On the other hand in registering on a kilogrammetric basis, the data is a unity of energy. The equivalent with other forces of energy, with heat for example, is well known.

Experiments have been made with sugar, and the data recorded are of exceptional importance. The results obtained differ somewhat from those of other investigators whose observations have been mainly centred upon the influence of sugar during long walks and other like varied exercises.

The reason of these apparent contradictions has been explained by Miss Kipiana, pupil of one of the Brussels Colleges. It was noticed that when a person has been well fed there is no dynamogene action of sugar on the ergograph. The work recorded is that of a single finger of the hand. In this case the sugar contained in the sanguine mass is sufficient to furnish the requisite work. Fatigue is due not only to the consumption of the aliments in reserve, but also to the muscle intoxication by the decomposition of products. The absorption of 30 grams of sugar in such cases has no effect, for the reason the sugar is already in excess. The results are very different if for one reason or another the blood sugar percentage has been reduced. In this case the work of the ergograph is very much lessened, and if

sugar is absorbed there will be an important dynamogene effect with the view of obtaining the best possible effect. A system of factory experiments was resorted to. The conditions were then recorded by way of comparison. Thirty grams of sugar were then dissolved in water and drunk. It was shown that the work was increased by 70 per cent. It is also interesting to refer to the action of sugar during child labour. It has been demonstrated that sugar, like ergot, has an influence on the contraction of the uterus. As there is no toxic to be feared through the use of sugar its value is that much greater. The best results were obtained by dissolving 25 grams of sugar in water and drinking the same at intervals of half-an-hour.

In a previous writing, mention was made of the value of sugar in the treatment of consumptives. The patients fed on sugar weighed the most, with a tendency to further fatten. This in most cases is an indication that the patient is cured, or at least is improving. Comparative experiments were made with fats, and sugar was pronounced the best. The explanation is that fatty substances, in order to be utilized, must be changed into sugar (glucose), and during transformation a large proportion of this energy is converted into heat; consequently it is lost for the individual who has no need of the excess of heat, especially in tropical countries. It is concluded, as far as the question is concerned of the organic regeneration, that fat is inferior to carbon hydrates, notwithstanding the theoretical equivalence.

The whole issue of the influence of sugar on the system has undergone important changes during the past few years, and most of the leading authorities do not hesitate to declare that the efficiency of the human machine increases when the work is accomplished with muscles having an ample supply of sugar at their disposal.—*Sugar Beet.*

FERTILIZERS.*

BY D. W. MAY, Agricultural Experiment Station, Porto Rico.

(Continued from page 397.)

POTASH.

This is an element of which the natural supplies are somewhat limited. The greatest deposits of potash are found in the Stassfurt mines of Germany and large amounts are shipped all over the civilised world. These potash salts are sold in their natural state as kainit and other forms, containing more or less impurities and running about 12 to 15 per cent. of potash. They are also sold in more concentrated forms, as sulphate and muriate. These contain about 50 per cent.

* It may be as well to observe that the word "Fertilizers" is used in the United States to describe "Manures" in general, and not only the special class of manure which the word implies in England.

potash. As we must import practically all of our potash, it is advisable to buy the more concentrated forms, as sulphate or muriate. Sulphate costs slightly more that muriate, but it is preferable to use on some crops. For example, the chlorine in the muriate of potash is believed to be bad for tobacco, affecting especially the burning quality of the leaf.

How to Determine Fertilizers Needed.

The idea prevails in Porto Rico that a chemical analysis will show what a soil needs. This is only true in part, as a chemical analysis may show a certain element present and yet owing to certain combinations in the soil the plant can not secure it. By far the better way is to apply fertilizers of different composition and note the results on small portions of land. This the planter can carry out himself, and in doing it he is studying all the conditions that influence his particular farm and crop. A scheme of this kind is now under trial at the experiment station. A portion of a field is divided into a series of ten twentieth-acre plats.

These plats are fertilized as follows:

Scheme of Plats for Fertilizer Experiments.

No. 1. Nothing.
No. 2. Nitrate of soda, 8 pounds, equal to 160 pounds per acre.
No. 3. Acid phosphate, 16 pounds, equal to 320 pounds per acre.
No. 4. Muriate of Potash, 8 pounds, equal to 160 pounds per acre.
No. 5. Nothing.
No. 6. Nitrate of soda, 16 pounds; acid phosphate, 16 pounds.
No. 7. Nitrate of soda, 16 pounds; muriate of potash, 8 pounds.
No. 8. Acid phosphate, 32 pounds; muriate of potash, 8 pounds.
No. 9. Nitrate of soda, 8 pounds; acid phosphate, 16 pounds; muriate of potash, 8 pounds.
No. 10. Nothing.

To one series of plats lime is also added to note its influence on the crops. It will be noted that these amounts are rather large, larger in fact than the planter will use in general practise, but they are made so in order that the indications may be plain. The planter should take notes of the condition of his plats from time to time, and by this means he can soon see what his particular soil and crop will need, and from the harvest from the crops on these small areas he can form some idea as to profit or loss. Such experiments will save large sums to the planter who is going to use fertilizers in any amount, and, moreover, it will teach him to observe and to follow a more rational scheme of agriculture. In applying fertilizers they should be broadcasted and harrowed in for small grains that stand close upon the ground. For cane they should be applied in the hill as a rule, as it is a practice at present in Porto Rico to use small amounts, and they should be so placed that the plant will get the greatest benefit from them without reference to the crops that are to follow. The fertilizers

not only diffuse themselves through the ground, but the roots of the plants will seek out the fertilizers. It is advisable on hill lands to bury the fertilizer to guard against leaching by the rains, to which many of our soils are quite subject.

Some such definite scheme of fertilizing as has been outlined is far better than to follow a hit or miss plan of using a fertilizer without knowing the demands of the soil and crop. The soil may need only the one element, while the planter may be adding all three. Of course, in such cases, he is adding elements that do not make any adequate return and he is therefore making an outlay that is not justified, but by starting with small areas and using different combinations of fertilizing elements he can determine what his soils need without being liable to any appreciable loss. He can begin with the natural fertilizers, as manures, bat guanos, &c., that are within reach and use commercial fertilizers only as he finds it profitable to do so. While it is doubtless true that most Porto Rican soils needs nitrogen, phosphorus, and potash, and many of them lime, yet the profitable combination is liable to vary very much, not only with different soils, but with different crops. It is found that different crops require more of one element and less of another. For example, corn requires all three—nitrogen, phosphorus, and potash—in rather liberal amounts. Other crops like the legumes, such as peas, beans and clovers, should have phosphorus and potash, and be allowed to secure their nitrogen from the air. These crops will, for about every 30 pounds of phosphorus and 100 pounds of potash, require 100 pounds of nitrogen. Of this latter they are probably getting a larger part from the air, which means clear gain of the most expensive element.

Sugar Cane.

The sugar cane is a crop that responds very readily to the use of fertilizers. From analyses made by the Louisiana Station, 30 tons of cane will remove 102 pounds of nitrogen, 45 pounds phosphorus, and 65 pounds potash. It is therefore an exhaustive crop, and the fertilizing materials should be returned to the soil. As the product is largely shipped from the field, it will readily be seen that large amounts of fertilizers are necessary in order to restore the elements taken away. Most of our plantations do not take the trouble to return the bagasse ashes, and they are applied by the centrals to their own fields, to the detriment of the farmers who sell the cane off their places. The cane plant is a vigorous feeder. It is able to extract the fertilizing elements from almost any kind of fertilizers. For growing cane, however, the fertilizers should be kinds that are readily dissolved.

At this station it has been found that a crop of cowpeas may be very readily grown between rows of cane. Alfalfa will also grow well, but as it is more expensive to seed, the cowpea will probably do

better. After the cowpea has made a pretty good growth it may be ploughed under, or the cane may be allowed to smother it. Bat guano from the caves of the island will prove very profitable for cane wherever it can be secured. A large amount of phosphorus may also be obtained from the waste material about the mill, as the bagasse ashes and the filter cake, all of which should be carefully saved and returned to the fields. While our experiments do not yet indicate the potash needs of our soils, it is probable that this is a very profitable element to aid. In Louisiana the soils contain a relatively large amount of potash, and this element has not been so much needed, while in Hawaii the soils are very deficient in this element and it has been found profitable to apply very large amounts. For plant cane a small amount of soluble fertilizer should be placed in the hill in order to give the seed a good start. It is a good practice in cane growing to start the cane off quickly, as there is a chance of making a larger return. A fork full of well-rotted manure or compost in the hill at planting time has given good results at this station. Later applications of fertilizers should be made broadcast and worked in with a plough or hoe. Nitrogen should be added early in the growth of the crop, as later applications tend to make a rank growth low in sugar. Phosphorus is needed at all times during the growth of the cane, as well as potash, although potash may be profitably added later.

CONSULAR REPORTS.

Santo Domingo.

The cultivation of cane sugar is one of the oldest agricultural industries of the Republic, having been in vogue for more than 300 years, with varying profits and occasional losses, according to the world's market price.

The climate and soil being well suited for the production of cane sugar, the average output since 1885 has been from 20,000 to 50,000 tons, the extent of land devoted to the growing of the cane being about 183,754 acres, divided between 14 estates.

It is noteworthy that most of the estates are owned by Americans, not one being British. The sugar is shipped in the raw state, there being no refinery in the Republic. 80 per cent. of the production polarizes 95° to 96°; 12 per cent., 81° to 83°, and the residue yields molasses of 42° which is used in the country for making rum.

Owing to the low market price of raw sugar, the sugar industry here is in great danger of becoming a thing of the past unless a radical change takes place. At the present price many of the planters are barely able to pay the interest on the large loans they have had to contract to keep up their plantations and meet other sundry heavy expenses which a sugar plantation is bound to have during a sequence

of bad years, always with the hope that better times must come and that prices must improve. "Hope deferred maketh the heart sick," and the planters are becoming tired of borrowing money with so little chance of matters improving, hence if some advantage is not given to Dominican sugar imported into the United States, the outlook of this industry is anything but bright.

Correspondence.

PROGRESS OF THE SUGAR INDUSTRY IN THE ISLAND OF FORMOSA.

TO THE EDITOR OF THE "INTERNATIONAL SUGAR JOURNAL."

Dear Sir,—As I have been a contributor and reader of your journal for a number of years past, I thought it might interest you, while I am in this country, to give you a few lines regarding the sugar industry in Formosa.

The island of Formosa was taken from China twelve years ago, as the result of the Chino-Japanese war. On exploring this island we found it was most suitable for the cultivation of sugar cane, and already there were in the island about a thousand very small mills for the manufacture of sugar, the cane juice being expressed by animal power mills; these were run by Chinese farmers—the small land-holders of Formosa—who are the class who grow and sell cane to the larger mills that have sprung up in the past five years. To-day we have about six hundred of these old mills left; and to take the place of the displaced ones, and to use up the canes from the enlarged cane areas there have been built about fifty larger factories of more or less modern equipment, and fifteen rank as centrals. Of the fifteen, seven are plants capable of working about 1,200 tons of cane daily; the other eight are from 150 to 1,000 tons capacity. The fifty smaller plants are run by steam power, and handle from 40 to 120 tons of cane per day. Most of the expensive machinery for these factories is brought from Europe. Owing to the geographical situation of Formosa we never have frost there; and, in consequence, our cane has a whole year to grow before it is cut for the mill, and our campaigns last, on an average, five months, beginning in the middle of November. Some mills, in sections where there may be shortage of labour, work until June. The smallest mills in Formosa make what might be called a muscovado sugar for immediate use, which is sold for consumption in Japan, where it brings, in American money and weight equivalent, about 4·50 dollars per 120 lbs. This year, on account of a monetary stringency, there is very little talk of erecting large mills in Formosa, only a few new mills at present

being projected. In 1906, however, when financial conditions were in better shape, quite a number of factories were started. In 1906 our production came to no more than 50,000 tons—that is, only about one-fifth of Japan's consumption—the remaining four-fifths being imported from Java. The Government is endeavouring as much as possible to encourage the development of the sugar business; and, to aid it, has placed a heavy import duty on sugar brought in from foreign countries: this amounts to an American equivalent of six dollars per 125 lbs. At our larger mills the most modern tramway systems for handling cane in cars are in use, and the Chinese farmers who generally grow rice and cane, are paid at the rate of two dollars per ton of 2,000 lbs. for their cane. The Centrals are dependent on the small farmers for their supply of cane, and so the sugar companies are trying, as much as possible, to get the growers to improve their agriculture; and in this they are aided by the Government, who, in a measure, subsidise the cultivation of sugar cane by offering to farmers free fertilisers and free seed cane. If these are accepted, the grower must guarantee to continue his cane areas for a period of five years. Our first aim is to improve agricultural methods, so as to increase cane yields from the existing 20 to 25 tons per acre up to 40 tons, which should be attained. The Experiment Station authorities are working to improve agriculture in Formosa, particularly in sugar cane. As present we use fertilisers to a very limited extent, do not irrigate the cane, and use poor implements, working the land at too shallow a depth. Our farmers use a species of water buffalo to plough with and do their own hauling, and only keep stubble one season. They plant only the tops of the cane stalks, which are cut to a length of 8ins. to 9ins., sticking these vertically in the ground. The Lahaina and Rose Bamboo are the two varieties of cane most grown, being brought from Hawaii. The Rose Bamboo is a red cane, and seems to do better in our lands. I am inclined to believe the reason the Lahaina does not do so well is that the ploughs do not cut deeper than four inches into the soil. One large sugar company in the island has lately bought two steam ploughs for the cultivation of the land supplying its factory, and the results are expected to attract more attention to the benefits of improved land preparation and cultivation. The sugar cane in Formosa, I know from experience, is very rich, and ordinarily contains from 18% to 20% sucrose, with correspondingly high purities. The common purity of the juice is 85%, but in about forty days of the campaign—from the latter part of January to the first part of March—the purity runs up to 90%, as determined at the larger factories in the island, where operations are conducted under strict chemical control. The megass furnishes 90% of the fuel in the best and largest plants, and the remaining fuel is coal brought from Japan, where it is mined, and costs about 32s. per ton, delivered in the estate.

I left Japan along with Mr. Aria, who is the President of the Ensuiko Sugar Co., being one of the largest in Formosa, having had its capital increased last year from 300,000 yen to 5,000,000 yen; this was in order to enlarge its scope of operations.

The present factory has a capacity of 350 tons of cane per day. A complete new factory is now about to be erected to work 1,200 tons a day. Mr. Aria and myself were commissioned by our company to visit America and Europe, and interview the various sugar machinery engineers and manufacturers, receiving estimates and specifications from same for the plant required, which we have now done; and, after due consideration, we have placed the order for this plant with the Harvey Engineering Company, Limited, of Glasgow: this firm supplied the machinery of our present small factory, and has given us complete satisfaction in every way, the excellency of their machinery being well-known in the island of Formosa.

S. Hori,
Director of the Ensuiko Sugar Co., Ltd., Formosa.

August, 1907.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Abridgments.

15744. G. W. Sutton, Stevenage, in the County of Hertford. *Improvements in hydro-extractors to facilitate the simultaneous rapid discharge of material from and scraping clean the inside of the revolving basket, as the material is being discharged from it.* 12th July, 1906. This invention relates to a centrifugal machine for driving off the moisture from tea leaf, cocoa and cocoa beans, wool and metal chips and the like, the employment of two, three, four, eight, or any number of trap-doors forming the whole of the bottom of the said revolving basket between the central boss or hub, deep narrow spokes or arms, and inner edge of the perforated side of the revolving basket, the said trap-doors being hinged to the said arms or spokes and arranged so as to open out downwards.

4620. M. Altolaguirre and J. Zubillaga, both citizens of the United States of America, residing at Artemisa, Cuba. *Apparatus for defecating cane juice.* 25th February, 1907. This invention relates to a defecating apparatus of the kind comprising a casing containing a heater, and an endless carrier provided with devices movable over liquid in the casing and arranged to remove scum from such liquid, the devices being distinguished by the fact that they consist of blades rigidly mounted on the endless carrier, and that

they are supported from end to end of the casing by horizontal supports.

GERMAN.—ABRIDGMENTS.

182934. JOSEPH ROBIN-LANGLOIS, of Paris. *Apparatus for making cubes from endless plastic sugar slabs.* 28th February, 1905. This invention relates to an apparatus for making cubes from endless plastic sugar slabs and ejecting the cubes from the moulding plates and comprises an endless chain running over guide rollers and toothed wheels, and carrying the moulding plates, each cube and its respective zinc plate being carried by a moulding plate which is pivotally suspended by means of two pins above its centre of gravity, so that when the cube, which is already partially separated from the sugar slab by a notch or groove, is fully freed, the moulding plate adjusts itself automatically horizontally, and during the vertical downward motion remains in this position until the zinc plate and the cube are removed by a separate mechanism. The arrangement for removing the cubes already mentioned lying on the zinc plates consists in one arm of a double lever being depressed by pins arranged on the links of the endless chain in its vertical descent, the other arm of which double lever consequently compulsorily pushes a metal plate under the zinc plate which has been already lifted off the moulding plate by fixed rests, whilst the further movement of the endless chain again releases the double lever and it returns by means of a counterweight into its initial position, and thereby pushes back the metal plate last mentioned and the zinc plate and the cube, so that the ejection of the cube may take place without stopping the machine.

183137. EMANUEL NUSSBAUM, of Vienna. *An apparatus for continuously drying thin pasty or fluid material, more particularly sugar molasses, which apparatus consists of two drying cylinders rotating in opposite directions and is provided with distributors arranged above the rollers.* 31st October, 1905. In this apparatus which has two drying rollers rotating continuously in opposite directions and distributors arranged over the rollers, these distributors are provided with rotating cylindrical shutting off devices, the cylindrical surfaces of which, in rotating, alternately close and open the outlets for the material to be dried, in order thereby to distribute the material in small quantities over the drying rollers. In another form of construction the shutting off device for the distributing apparatus is formed by rotary discs slotted at intervals on the periphery, the lower parts of which suitably rub in the distributors.

184644. AUGUST GRANTZDÖRFFER, of Magdeburg. *Process and apparatus for partially freeing molasses from sugar.* This process of removing sugar from molasses which contains crystallizable sugar, consists in the molasses being heated to about 60° C. and then filtered through sugar during its cooling down to about 40° C. The apparatus for carrying out this process consists in a vessel divided into three

compartments and pivotally mounted on a horizontal axis, the central compartments of which vessel may be filled with sugar, whilst the two outer compartments serve for receiving the molasses.

184801. MASCHINENBAU-ANSTALT KÖLLMANN G.m.b.H., of Langerfeld, Westphalia. *A machine for automatically cleaning the heating-pipes of heaters for sugar juice and the like.* 7th February, 1906. In this machine there is a cleaning-brush adapted to be moved to and fro in two directions, at right angles to one another, by means of a slide and a carriage supporting it over the mouths of the pipes, and the essential feature being that the slide is connected with the carriage by means of a mechanism operating the reciprocatory motion of the slide and also the to and fro movement of the carriage, which mechanism also operates a device for moving the cleaning-brush up and down. Another feature consists in the brush being brought back in automatic operation in cleaning the last pipe of the first row, by the carriage first over the same row almost to the middle and then by means of a movement of the carriage which proceeds simultaneously with the slide movement, in an oblique direction over the next row, then conveyed by a movement of the slide to the first pipe of this row, and so from row to row up to the last row of pipes, from which, by a continuous return of the carriage, the transfer of the brush to the first row takes place. Another feature is that an empty mould mounted on the slide and displaceable independently of the slide movement and also in the direction of the travel of the carriage, limits the to and fro movement of the slide corresponding to the length of the row of pipes, which acts on two facing rows of stops on a pawl device producing the change of movement of the slide, and has so many stops in each row as there are rows of pipes, in such a way that the distance of one stop of one row from the respective stop of the facing row always corresponds to the length of the respective row of pipes.

185651. WILHELM HAASE, of Halle-on-Saale. *An apparatus for discharging centrifugals, more particularly for the sugar industry.* 4th March, 1906. This discharging apparatus consists of chambers formed permanently in the centrifugal or inserted therein from the outside, in which the chambers which fill up the hollow part of the centrifugal in the direction of the radii are so revolubly mounted on contrifugal spindle that they turn with the centrifugal drum during the centrifugalling, but on the completion of the centrifugalling may be rendered stationary by means of a brake device arranged outside the centrifugal, for instance on a shaft, whilst the drum of the centrifugal continues to rotate.

185654. MASCHINENFABRIK GREVENBROICH, of Grevenbroich, Rhine Province. *Apparatus for squeezing or pressing substances, more particularly beetroot shreddings, by means of endless belts running over rollers.* 25th August, 1906. In this apparatus the distance between

the belts diminishes towards the place at which the material pressed is discharged, and, further, the belts have different speeds and different directions of movement, in such a way that they are constantly displaced relative to one another, with the object of constantly mixing the materials during the squeezing or pressing.

185655. Dr. R. Stutzer, of Güstrow. *Process for purifying heated crude sugar juice with lime and silicious sinter.* 29th January, 1905. In this method of purifying heated sugar crude juice with lime and silicious sinter (or quartz), the silicious sinter and lime must be used in a certain succession which should not be reversed, namely, after the complete precipitation of the albumens and the formation of a syrup capable of being filtered; crude unwashed and unfired silicious sinter is first added to the hot raw syrup and thoroughly stirred into it, and then lime is added without previous filtration.

185829. Rudolf Bergmans, of Kalt, near Cologne. *A process for evaporating solutions, more particularly sugar solutions.* 26th June, 1906. This invention relates to a process for evaporating solutions, more particularly sugar solutions, utilizing the vapour given off, and consists in the vapour evolved from the solution being converted into hot steam by means of converter nozzles of the ordinary type, in such a way that the vapour flowing from the evaporator is first superheated in known manner, and then the conversion effected, and finally the converted vapour conveyed to the evaporator for heating the solution.

185830. Maschinenfabrik Grevenbroich, of Grevenbroich. *A turn table more particularly for the insertions for producing sugar slabs.* 18th September, 1906. The characteristic feature of this invention is that the turn table or revolving frame is provided with several revoluble discs mounted thereon, on which the insértions are placed. The turning disc for use in connection with the turning table is characterised by arms of the turn table which runs on wheels and rests on a turn post, being provided with step bearings in which the rotary discs which rest on rollers move by means of adjustable pins.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM

To end of July, 1906 and 1907.

IMPORTS.

Raw Sugars.	Quantities. 1906. Cwts.	1907. Cwts.	Values. 1906. £	1907. £
Germany	5,589,703	4,668,804	2,377,119	2,191,147
Holland	47,430	158,670	17,981	75,100
Belgium	289,697	218,998	116,323	97,810
France	162,362	276,955	69,187	139,399
Austria-Hungary	158,178	275,115	64,495	124,033
Java	158,997	165,794	73,466	87,121
Philippine Islands	....	188,886	....	77,287
Cuba	111,885	91,113	41,943	39,610
Peru	426,867	304,139	192,997	148,426
Brazil	953,452	189,486	373,554	78,150
Argentine Republic	....	....	....	....
Mauritius	1,126,741	442,440	48,362	180,811
British East Indies	77,862	101,050	30,543	43,073
Straits Settlements	48,840	111,472	20,394	46,453
Br. W. Indies, Guiana, &c.	1,333,398	1,013,882	712,966	586,117
Other Countries	168,347	486,672	77,610	241,279
Total Raw Sugars	9,653,768	8,693,476	4,216,940	4,155,816
Refined Sugars.				
Germany	7,289,849	8,040,865	4,139,609	4,732,440
Holland	1,679,823	1,544,487	1,005,130	973,022
Belgium	221,090	177,388	127,924	107,907
France	1,311,895	2,144,981	730,557	1,248,487
Other Countries	436	2,609	323	1,806
Total Refined Sugars	10,503,093	11,910,330	6,003,543	7,063,662
Molasses	1,608,993	1,698,617	305,754	328,627
Total Imports	21,765,854	22,302,423	10,526,237	11,548,105

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	127	292	114	220
Norway	9,870	8,977	5,933	5,418
Denmark	63,824	60,802	32,107	32,676
Holland	44,827	39,941	26,600	26,845
Belgium	5,821	5,578	3,268	3,363
Portugal, Azores, &c.	18,260	13,421	9,871	7,472
Italy	22,345	13,445	11,419	7,121
Other Countries	373,325	273,996	239,935	201,311
	538,399	416,452	329,247	287,426
Foreign & Colonial Sugars				
Refined and Candy	27,224	21,265	16,585	13,928
Unrefined	136,457	54,748	69,923	32,731
Molasses	5,464	4,035	1,742	1,164
Total Exports	707,544	496,500	417,497	335,249

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to August 22nd..	1,416,160	..	1,368,354
Receipts of Refined ,, ,, ...	670	..	1510
Deliveries ,, ,, ...	1,398,164	..	1,398,164
Consumption (4 Ports, Exports deducted) since January 1st..	1,257,000	..	1,271,400
Importers' Stocks, August 21st	17,996	..	26,501
Total Stocks, August 28th	284,000	..	270,835
Stocks in Cuba, ,, ...	86,000	..	77,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1906 AND 1907.

(Tons of 2,240lbs.)	1906. Tons.		1907. Tons.
Exports	983,101	..	1,217,259
Stocks	142,881	..	155,060
	1,125,982	..	1,372,319
Local Consumption (seven months)	25,950	..	26,730
	1,151,932	..	1,399,049
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 31st July	1,132,482	..	1,399,049

Havana, July 31st, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR SEVEN MONTHS ENDING JULY 31ST.

SUGAR.	Imports. 1905. Tons.	1906. Tons.	1907. Tons.	Exports (Foreign). 1905. Tons.	1906. Tons.	1907. Tons.
Refined	400,458	525,154	595,516	628	1,361	1,063
Raw	383,916	482,688	434,674	2,185	6,823	2,737
Molasses	70,160	80,449	84,931	132	273	202
Total..........	854,534	1,088,291	1,115,121	2,945	8,457	4,002

	Home Consumption. 1905. Tons.	1906. Tons.	1907. Tons.
Refined..	401,596	504,643	571,456
Refined (in Bond) in the United Kingdom	304,954	327,450	290,314
Raw	59,060	73,343	71,749
Molasses	65,311	73,776	76,930
Molasses, manufactured (in Bond) in U.K.	30,422	34,330	37,912
Total..................................	861,343	1,013,542	1,048,361
Less Exports of British Refined....................	12,860	26,920	20,822
Total Home Consumption of Sugar	848,483	986,622	1,027,539

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, AUG. 1ST TO 24TH, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1907.
156	392	397	259	80	1284

	1906.	1905.	1904.	1903
Totals	1558 ..	1107 ..	1478 ..	1749

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING JULY 31ST, IN THOUSANDS OF TONS.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1875	1242	640	548	204	4510	4226	3882

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1906-1907.	1905-1906.	1904-1905.	1903-1904.
	Tons.	Tons.	Tons.	Tons.
Germany	2,250,000 ..	2,415,136 ..	1,598,164 ..	1,927,681
Austria	1,335,000 ..	1,509,870 ..	889,373 ..	1,167,959
France	755,000 ..	1,089,684 ..	622,422 ..	804,308
Russia	1,450,000 ..	968,000 ..	953,626 ..	1,206,907
Belgium	280,000 ..	328,770 ..	176,466 ..	209,811
Holland	190,000 ..	207,189 ..	136,551 ..	123,551
Other Countries .	440,000 ..	415,000 ..	332,098 ..	441,116
	6,700,000	6,933,649	4,708,758	5,881,333

THE

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☞ All communications to be addressed to the Editor, Office of "The Sugar Cane," Altrincham, near Manchester.

All Advertisements to be sent direct.

Cheques and Postal Orders to be made payable to NORMAN RODGER, Altrincham.

The Editor will be glad to consider any MSS. sent to him for insertion in this Journal and will endeavour to return the same if unsuitable; but he cannot undertake to be responsible for them unless a stamped addressed envelope is included.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTICE TO READERS.—If the Advertisement pages stick together, bang their edges on the table, when they should easily separate.

NOTES AND COMMENTS.

Jamaica and the Sugar Convention.

When Sir Alexander Swettenham was forced to resign his position as Governor of Jamaica owing to the friction with the American naval officers on the occasion of the Kingston earthquake, the Home Government appointed Sir Sidney Olivier to succeed him. The latter was supposed to be a man after their heart, a Radical with pronounced views; but if they therefore thought that he would quietly acquiesce in the danger that threatened Jamaica through the abolition of the Sugar Convention, and would prove indifferent to the protests of the Jamaicans, they were sadly deceived. The new Governor is a strong man, and having quickly mastered the situation has given expression to his views with no mincing of words. Last July he addressed a despatch to the Secretary for the Colonies, Lord Elgin, with regard to the question of the continuance of the Brussels Convention. It is worth remembering that his knowledge of West Indian affairs has not been confined to the term of his present office, as he was Secretary of the West India Royal Commission of 1897, and in that capacity had the opportunity of seeing for himself the havoc that was wrought by the foreign sugar bounties.

Not content with forwarding the views of the Jamaica public bodies, he has himself a good deal to say in the matter, and the unanswerable logic of his arguments must have duly impressed the home authorities, if they are indeed capable of being so moved. He points out that if it be true that the prohibition of the supply of sugar from a few bounty-granting countries so restricts the sugar market as to cripple the sugar-using industries, and that the interests of these industries are measurable in terms of the price of sugar, then it is straining at a gnat and swallowing a camel to denounce the exclusion of such bounty-fed sugar which cannot affect the price by more than a few pence per cwt., while maintaining unimpaired the heavy British import duty of 4s. 2d. per cwt. This is very true, and we have ourselves more than once pointed out that the sugar users were blaming the Convention for the evils which were solely due to the high excise duty. If, as we rather anticipate, this obnoxious duty is taken off next spring, we shall thenceforward hear very little more complaint from the sugar users about the price of their raw material. And then perhaps the Convention will be left in peace and our West Indian sugar producers will be allowed to continue to work under fair trade conditions.

The West Indian Agricultural Conference, 1908.

In spite of the earthquake which brought last year's Conference to so sudden and tragic a termination, it is proposed to hold the 1908 Conference in Jamaica again. A general feeling has been expressed that such a step would tend to restore confidence amongst tourists and others who might otherwise give this large colony the go-by. Negotiations are therefore on foot to make the coming meeting a success, and the Jamaica Agricultural Society are giving the matter their full support. It is thought that Mandville would be the best place for the Conference, as the physical surroundings would be of interest to the visitors. No definite arrangements have yet been announced, but it is expected that the Imperial Commissioner will fall in with the suggestions made.

Sugar Refining in Bristol.

Attempts to revive the sugar-refining industry in Bristol have culminated in the formation of a Company to acquire the old Market Street refinery, containing machinery and plant in working order to deal with 400 tons of sugar per week. Under the name of the Bristol and West of England Sugar Refinery, Ltd., it will have a capital of £30,000, and Mr. W. Howell Davies, M.P., is to be the chairman. A preliminary expenditure of £3000 is said to be all that is required in order to bring the refinery up to date.

While dealing with Bristol affairs, mention might be made of some interesting particulars of the old Bristol sugar trade which were

recently supplied to the *Western Daily Press* by a correspondent. As giving some idea of the trade in 1790 he stated that at that period Bristol possessed 18 sugar refiners and about 40 West India merchants. The West Indian sugar was brought home in hogsheads and tierces, which latter maintained a large cooperage industry. In fact, the coopers got so independent that the cost of hogsheads was raised to an excessive price, and this led to the introduction of sugar bags in their place.

Glasgow's Opinion of the Sugar Convention.

At a meeting of the Glasgow Chamber of Commerce, on September 9th, the subject of the Sugar Convention was brought up for discussion, and the following resolution was proposed by Mr. Alexander Wylie :—

"In 1899 the Glasgow Chamber of Commerce and Manufacturers memorialised H.M. Government in favour of countervailing duties upon bounty-fed sugar, and now the directors, looking to the great success of the policy then recommended since it was adopted by the Brussels Sugar Convention in 1903, inasmuch as it has been the means of nearly abolishing sugar bounties, which for many years acted very powerfully against the interests of sugar growing in our Colonies, and of sugar refining in this country, and also inasmuch as it has ensured a continuance of the supply of cane sugar, which is of vital importance, increased the production of sugar within the Empire, and helped to give larger business to the sugar-using trades, earnestly request H.M. Government to reconsider their decision to withdraw from the terms of the Convention by which it was agreed to prohibit the importation of, or impose countervailing duties upon, bounty-fed sugar, a decision which has already had an unsettling effect upon our home and Colonial sugar industries, and may yet cause a return to the former injurious system of bounties."

Reference was made to the extent to which Glasgow had suffered in the past through the bounties, and emphasis was laid on the fact that she would be bound to suffer if the Convention was destroyed. One speaker remarked that the confectioners had been crying "Wolf, wolf!" without any reason, as their export trade had been steadily increasing. The meeting were evidently of one mind with regard to the Convention, for the resolution was carried unanimously.

Greenock and the Sugar Trade.

The Greenock Chamber of Commerce have naturally not been behind their neighbours in impressing on the Government the importance of maintaining the Sugar Convention unimpaired, and they, too, have addressed the Government on the subject. Sugar refining is one of the staple industries of that town, and they have been engaged at it for 140 years. Some figures prepared to show the output of British refining for the last 21 years are decidedly instructive. In 1887 909,903 tons of sugar were melted in British refineries; the

output then dropped till 1902, when the amount was only 580,505 tons. Since 1902 there has been a slow but steady increase, and the figures for 1906 were 670,846 tons. Below we reproduce the table appearing in a memorial sent to Sir Edward Grey last July :—

Year.	Meltings in British Refineries. Tons.	Imports of Foreign Refined. Tons.	Annual Consumption. Tons.	Average Price of 88% Beet f.o.b. Hamburg. s. d.
1886........	899,785	319,634	1,146,414	12 0
1887........	909,903	319,072	1,173,338	12 2
1888........	916,759	314,959	1,182,612	14 3
1889........	899,124	449,411	1,282,660	16 11
1890........	837,401	473,255	1,249,110	12 7
1891........	847,758	544,929	1,335,576	13 3
1892........	819,077	582,386	1,281,528	13 7
1893........	786,000	557,514	1,255,250	16 2½
1894........	738,237	688,306	1,348,519	11 6½
1895........	768,260	707,535	1,402,409	9 9½
1896........	734,000	724,976	1,384,034	10 6¼
1897........	654,732	772,994	1,3[illegible],516	8 10¼
1898........	684,083	794,581	1,435,566	[illegible] 5¾
1899........	617,801	868,025	1,447,326	10 0
1900........	589,437	934,789	1,488,535	10 4¾
1901........	582,084	1,044,315	1,592,543	8 6¾
1902........	580,505	1,000,277	1,539,461	6 7½
1903........	595,943	925,783	1,465,345*	8 3
1904........	668,095	863,464	1,496,831	10 0¾
1905........	641,687	746,360	1,353,796†	11 6½
1906........	670,846	891,869	1,510,434	8 7½

Sugar Prices in London, Paris, and Berlin.

A Board of Trade return has recently been issued showing the retail prices of the kind of sugar most largely consumed by the working classes in London, Paris, and Berlin, on the 1st of March during the past five years. This table as compiled to 1906 was given by us in our issue of June, 1906. It is therefore only necessary to add here that the prices in vogue on March 1st, 1907, were exactly the same as in the preceding year. They were: London, 2d. per lb.; Paris, 3d. per lb.; Berlin, 2¼d. per lb.

The Hadi Process of Sugar Making.

The Hadi process of sugar making has been given a trial in India, and seems to have met with no small success. Dr. Lehmann, the Agricultural Chemist to the Government of Mysore, reports that the light colour of the refined sugar made by this process has surprised him. He had been told that such sugar could not be produced if

* Convention began September 1st. † 1,200,000 tons short in beet crop.

lime were used. The sugar was, however, limed to slight alkalinity. It was boiled down in an ordinary iron country sugar pan and centrifugalled in a small laboratory machine.

Sugar Factory Boilers.

Water-tube boilers seem now-a-days indispensable for the up-to-date sugar factory and it is to be noted that in all the three recent orders for central factories for Formosa,* the boiler installations are to consist of Babcock and Wilcox patent water-tube boilers with special furnaces for burning green megass. For the three factories, 13 boilers in all have been ordered.

THE NEW SUGAR CONVENTION.

The "Acte additionnel" has been signed at Brussels; but will it be ratified? It may, but we have our doubts. Another question, Russia was proposing to join the Convention; but is she likely to do so now that her sugar, with its bounty, is to have free access to British markets in competition with other continental beetroot sugar receiving no bounty? This suggests a further question: will the great sugar industries of France, Germany and Austria, whose bounties were abolished because Great Britain guaranteed them against bounty-fed competition in her markets, quietly submit to the removal of that guarantee—the very essence of and sole inducement for, the conclusion of the original Convention? The mutterings of the coming storm are already in the air, the industries are crying out; the press, with its usual exaggeration, is drawing terrible pictures of the ruin awaiting the sugar industry when the new régime comes into force next September. Everything points to a fight in the various legislative Assemblies between now and then. Deputies are to be urged to oppose ratification, and we know how ready they are on the other side of the Channel to respond with energy and enthusiasm to appeals from the industries of their country when danger threatens.

This opposition has some basis of sound reason, but the agitators should avoid the temptation to exaggerate their case. They talk of the great fall in prices which will result from the re-admission of bounty-fed sugar to British markets, forgetting that a fall in price resulting from bounties is caused solely by the excessive production stimulated by the bounties, bringing with it overloaded markets and a consequent depreciation of values. That result came inevitably when all the great sugar industries of Europe were stimulated to over-production by their bounties; but now the stimulus is applied to Russia alone, a country with an increasing home consumption (in

* For details of the last order see page 518.

spite of high duties) and an increasing outlet for its surplus stock in Eastern countries. It is true that although Russia got rid, some years ago, of its excessive stocks, and has had during recent years barely enough to supply its ordinary export markets in Finland, Persia, and Turkey, it had, in 1906, a very large crop which has reconstituted its stock of sugar for export, and it may, therefore, be compelled to send some sugar next year to British markets. Our Government, and their friends the confectioners, will in that case cry out "We told you so," and will attribute the reintroduction of Russian sugar to the denunciation of the penal clause, whereas the real cause will be the large crop of 1906. It is possible that our re-opened door to bounty-fed sugar may give some little stimulus to production in Russia, in spite of the fact that export to Great Britain from that country will always be at a loss; but the effect of such small over-production in one country, especially under the exceptional geographical and economical position of that country, will be practically inappreciable. The dismal forebodings of the other European sugar producers may therefore be dismissed as unfounded as far as this particular point is concerned.

The supposed objections to the one-sided agreement recently signed at Brussels are well stated in the *Journal des Fabricants de Sucre* of the 18th September. M. Dureau begins with the one to which we have just referred. Whether the bounty-fed sugar goes direct into our consumption or after being refined, he argues that in either case it comes into direct competition on the British market with the sugars, free from bounty, of the contracting States, "and forces the producers of those sugars, on pain of finding no buyer, to reduce their price in proportion to the bounty on the competing product." This is a fallacy. The bounty-fed sugar is sold at the world's price, and the bounty only reduces that price when it causes more sugar to be produced than the world wants. This answer applies also to M. Dureau's next point. If the bounty-fed sugar, he says, is used in the production of confectionery, the British confectionery thus obtained if sent to the contracting States "will inflict on similar products of those States a ruinous competition." Thirdly, he contends that the bounty-fed sugars admitted to British markets, merely by their presence on those markets reduce the world's price of sugar. The reply is that wherever they go they reduce the world's price of sugar, if they go in sufficient quantities to have any appreciable effect. But in the present case it is only the excess of Russian exports, beyond the normal quantity required to supply Finland and the eastern markets now habitually supplied by Russia, that can have any abnormal effect on the world's stock and therefore on the world's price. That excess has never amounted to more than one or at the most two hundred thousand tons. That is a small amount to have any appreciable effect on the price of twelve million tons.

M. Dureau's last point is a true one. The re-opening of British markets to bounty-fed sugar puts an end to the opportunity of inducing Russia, or any other bounty-giving State. to join the Convention and reform its tariff by abolishing its bounties. This is a real and vital objection to the new sugar Convention and is quite sufficient in itself to condemn it.

This leads naturally to the consideration of the chances which existed before the denunciation of the penal clause of getting Russia within the fold. The subject has been examined with skill and insight by M. Sachs in recent numbers of the *Sucrerie Belge*. In the September number of the *International Sugar Journal*, in dealing with the subject of the Government and the Sugar Convention, we touched on the proposal put forward by Russia for joining the Convention, and exposed the unsoundness—we might say deception—on which it was based. M. Sachs, who has received reliable information from St. Petersburg, confirms our statement of the terms proposed and raises similar objection to them. We pointed out that the Russian Government offered to bring their surtax into accordance with the Convention, not by reckoning their excise duty at the actual figure of 1 R. 75 per poud, but by taking the imaginary figure of 3 R. 50 which would have to be paid by sugar not permitted by law to go into home consumption except on those terms. Of course no sugar ever pays that duty and therefore we are correct in describing it as imaginary. The duty of 1 R. 75 actually paid on sugar going into consumption is, as M. Sachs points out, equal to fr. 28·49 per 100 k. The double figure, 3 R. 50, is, therefore, fr. 56·98 per 100 k. To this Russia desires to add, not the legal surtax of 6 fr. per 100 k., but a special surtax, under her exceptional circumstances, of R. 0·50 per poud, which is 8 fr. 14 per 100 k. The total import duty which Russia asks to be permitted to levy amounts, therefore, to fr. 65·12 per 100 k.—about 26s. per cwt. As the consumption duty is only fr. 28·49 per 100 k., this would give Russia a surtax of fr. 36·63 instead of 6 fr. Russia may have some claim to exceptional treatment on account of her high cost of production, but six times the legal surtax is a little too much to ask. The cost of production in Russia, as quoted by the *Deutsche Zuckerindustrie* from a publication by M. J. Ziechanowski, varies from 1 R. 35 to 2 R. per poud, or in francs per 100 k., as stated by M. Sachs, from fr. 21·98 to fr. 32·56. These figures do not justify any such claim as that put forward by Russia.

Another reason why Russia is justified in asking for an exceptional position as to surtax has a better foundation. The distances in Russia are enormous. To send sugar for instance from Kieff to St. Petersburg involves heavy freight charges. Russia therefore requires a high surtax against the possible importation of foreign sugar. M.

Sachs suggests varying rates in proportion to the distance of the frontier from the sugar producing districts.

If Russia asks to be put in the same position in the Convention as that enjoyed by Italy and Sweden it may be hastily replied that that position is subject to the condition that they do not export. In the case of Russia it would be reasonable to modify that condition. She has her own sphere of exportation in Finland, Central Asia, Persia and Turkey, where her sugar, from natural causes, is most favourably situated and can therefore be sold without loss. It would be quite reasonable, therefore, to make concessions to her on that point.

There remains the main question, how to modify the Russian legislation in such a way as to suppress every artificial incitement to over production. This is necessary as much in the interests of the Russian producer as in those of his foreign competitor. The provisions of the new law of 1903 were framed with that view and have been partially successful; but there is need for further improvement if all objections from the international point of view are to be removed.

After each factory has exercised its right of selling for home consumption 80,000 pouds (about 1,300 tons) the remainder of its production is divided as follows:—

74·86 per cent. for home consumption.
10·47 ,, ,, for compulsory stock.
14·67 ,, ,, for exportation or carrying over to next season as part of its contingent for that year.

Exportation or carrying over involves loss, which is compensated by the high price obtained in the home market. The larger the production of the factory, the larger will be, eventually, its share in the supply of the home market, because the "normal production" of each factory is calculated on its average production during the three largest of the last eight crops.

The British Delegates at the Brussels Conference of 1898 suggested that the remedy would be to make the normal production of each factory a final figure, not be modified by any further estimate. M. Sachs now proposes what is practically the same remedy. He says: "It would suffice to modify the Russian sugar legislation in this sense, that the fabricants (each fabricant) be authorised to sell to the home consumption *a priori* as much sugar as they (he) sold in the preceding year." This would have to be confined to factories which have existed for a certain number of years. Younger factories, or those about to be built, would be subject to other arrangements, so as not to impede their development. By "*a priori*" we presume M. Sachs means that each factory would also receive its proper share of the increase of consumption. Provision would also have to be

made for cases where, from any accidental cause or failure of crop, a factory had been compelled to produce less than its usual quantity. There would be no difficulty in making such a provision.

All this shows that there would have been good hope, or at all events good means for securing that Russia could join the Convention on terms reasonably acceptable by both parties. But now that bounty-fed sugar is to be admitted into the United Kingdom on equal terms with other sugar this hope vanishes. Russia will enjoy an exceptional position without any further trouble or anxiety, and the only remaining point of interest is the attitude of the great producing industries of France, Germany, and Austria, and what will happen if their Governments or Parliaments refuse to ratify the new Convention.

RAPID ESTIMATION OF WATER IN SUGAR-HOUSE PRODUCTS, SUCH AS SYRUPS, MASSE-CUITES, &c.

By Hugh Main, B.Sc., F.C.S.

The usual methods of estimation of water in syrups by drying with sand, &c., are slow and unsatisfactory, especially if invert sugar is present.

For some time I have used the Abbe refractometer for this purpose and find it exceedingly simple, very rapid, the whole operation only taking about a minute, and accurate to 0·1%.

All that is required is that two or three drops of the syrup should be placed between the prisms of the instrument, the line of total refraction adjusted, and the refractive index read off, from which the per cent. of water is found on reference to the table given below.

In pure sugar solutions the sugar present, as is well known, can be accurately determined by means of the refractive index. However, for the usual refinery syrups except the lowest, such as molasses, I found that the refractive index was a measure of the total solids present, or what amounts to the same thing, 100 — total solids = % water in the sample.

The water in masse-cuites, syrups containing grain, or wet and sticky sugars, can also be easily estimated in a short time.

It is not proposed to give here a description of the Abbe refractometer, as this is given by Messrs. Carl Zeiss in their catalogue, together with the ordinary method of using it. Details, however, of the necessary points for the particular purpose in hand may be useful.

The instrument should be used in a room whose temperature is about 20°C. During use the prisms must be kept at this temperature by passing a current of water through them.

In the case of syrups, a few c.cm. of the sample are put in a small aluminium or nickel dish, preferably provided with a cover. The temperature of the syrup is quickly brought to exactly 20°C. by putting the dish into warm or cold water as required, a delicate thermometer being inserted and used for stirring the liquid.

The instrument is opened so that the prisms lie horizontally, and two or three drops of the syrup are put on the prism nearest to the telescope by means of the bulb of the thermometer. The other prism is then brought over and fastened, and the instrument erected.

The border line is adjusted and read as per the instructions supplied by Zeiss in their catalogue on pages 3 and 4. Three readings are made and the mean taken. A reference to the table then gives the per cent. of water in the syrup.

Very thick syrups, those containing crystals, masse-cuites, &c., require to be dissolved in a known weight of water and the refractive index read. A nickel basin, 5 cm. dia. and 4·5 cm. deep, and a glass-stirring rod are tared together, and 10 grammes of the masse-cuite weighed in. Ten c.cm. of hot distilled water are then added and all the grain is dissolved, gentle heat being applied if necessary. After cooling to the temperature of the room the basin is reweighed, and the amount of added water is found by difference. The temperature of the syrup is quickly adjusted to 20°C. as before and the reading taken in the refractometer.

The percentage of original water is calculated thus :—

10 grammes of masse-cuite taken.
20 ,, ,, and added water.

10 ,, water added.

The mixture gave 55% water by the refractometer.

∴ in 20 grammes of the mixture are—

$$\frac{55}{100} \times 20 = 11 \text{ grammes water.}$$

so 11 grammes of water in mixture—
10 ,, ,, added.

1 gramme of original water in 10 grammes masse-cuite.
= 10%.

After each determination the prisms are cleaned with small pieces of wet filter paper and then wiped dry with a soft linen handkerchief.

TABLE FOR ESTIMATION OF WATER IN SUGAR SOLUTIONS BY MEANS OF THE ABBE REFRACTOMETER.

Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.
1·3330	100	1·3397	95·2	1·3469	90·4	1·3545	85·6
1·3331	99·9	1·3399	95·1	1·3471	90·3	1·3546	85·5
1·3333	99·8	1·3400	95	1·3472	90·2	1·3548	85·4
1·3334	99·7	1·3402	94·9	1·3474	90·1	1·3549	85·3
1·3336	99·6	1·3403	94·8	1·3475	90	1·3551	85·2
1·3337	99·5	1·3405	94·7	1·3477	89·9	1·3552	85·1
1·3338	99·4	1·3406	94·6	1·3478	89·8	1·3554	85
1·3340	99·3	1·3408	94·5	1·3480	89·7	1·3556	84·9
1·3341	99·2	1·3409	94·4	1·3481	89·6	1·3557	84·8
1·3343	99·1	1·3411	94·3	1·3483	89·5	1·3559	84·7
1·3344	99	1·3412	94·2	1·3484	89·4	1·3561	84·6
1·3345	98·9	1·3414	94·1	1·3486	89·3	1·3562	84·5
1·3347	98·8	1·3415	94	1·3488	89·2	1·3564	84·4
1·3348	98·7	1·3417	93·9	1·3489	89·1	1·3566	84·3
1·3350	98·6	1·3418	93·8	1·3491	89	1·3567	84·2
1·3351	98·5	1·3420	93·7	1·3492	88·9	1·3569	84·1
1·3352	98·4	1·3421	93·6	1·3494	88·8	1·3571	84
1·3354	98·3	1·3423	93·5	1·3496	88·7	1·3572	83·9
1·3355	98·2	1·3424	93·4	1·3497	88·6	1·3574	83·8
1·3357	98·1	1·3426	93·3	1·3499	88·5	1·3576	83·7
1·3358	98	1·3427	93·2	1·3500	88·4	1·3577	83·6
1·3359	97·9	1·3429	93·1	1·3502	88·3	1·3579	83·5
1·3361	97·8	1·3430	93	1·3503	88·2	1·3581	83·4
1·3362	97·7	1·3432	92·9	1·3505	88·1	1·3582	83·3
1·3364	97·o	1·3433	92·8	1·3507	88	1·3584	83·2
1·3365	97·5	1·3435	92·7	1·3508	87·9	1·3586	83·1
1·3366	97·4	1·3436	92·6	1·3510	87·8	1·3587	83
1·3368	97·3	1·3438	92·5	1·3511	87·7	1·3589	82·9
1·3369	97·2	1·3439	92·4	1·3513	87·6	1·3591	82·8
1·3371	97·1	1·3441	92·3	1·3515	87·5	1·3592	82·7
1·3372	97	1·3442	92·2	1·3516	87·4	1·3594	82·6
1·3373	96·9	1·3444	92·1	1·3518	87·3	1·3596	82·5
1·3375	96·8	1·3445	92	1·3519	87·2	1·3597	82·4
1·3376	96·7	1·3447	91·9	1·3521	87·1	1·3599	82·3
1·3378	96·6	1·3448	91·8	1·3522	87	1·3600	82·2
1·3379	96·5	1·3450	91·7	1·3524	86·9	1·3602	82·1
1·3380	96·4	1·3451	91·6	1·3526	86·8	1·3604	82
1·3382	96·3	1·3453	91·5	1·3527	86·7	1·3605	81·9
1·3383	96·2	1·3454	91·4	1·3529	86·6	1·3607	81·8
1·3385	96·1	1·3456	91·3	1·3530	86·5	1·3609	81·7
1·3386	96	1·3457	91·2	1·3532	86·4	1·3610	81·6
1·3387	95·9	1·3459	91·1	1·3533	86·3	1·3612	81·5
1·3389	95·8	1·3460	91	1·3535	86·2	1·3614	81·4
1·3390	95·7	1·3462	90·9	1·3537	86·1	1·3615	81·3
1·3392	95·6	1·3463	90·8	1·3538	86	1·3617	81·2
1·3393	95·5	1·3465	90·7	1·3540	85·9	1·3619	81·1
1·3394	95·4	1·3466	90·6	1·3541	85·8	1·3620	81
1·3396	95·3	1·3468	90·5	1·3543	85·7	1·3622	80·9

Estimation of Water in Sugar Solutions.—*Continued.*

Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.
1·3624	80·8	1·3709	75·7	1·3799	70·6	1·3893	65·5
1·3625	80·7	1·3711	75·6	1·3801	70·5	1·3895	65·4
1·3627	80·6	1·3713	75·5	1·3803	70·4	1·3896	65·3
1·3629	80·5	1·3714	75·4	1·3805	70·3	1·3898	65·2
1·3630	80·4	1·3716	75·3	1·3806	70·2	1·3900	65·1
1·3632	80·3	1·3718	75·2	1·3808	70·1	1·3902	65
1·3634	80·2	1·3719	75·1	1·3810	70	1·3904	64·9
1·3635	80·1	1·3721	75	1·3812	69·9	1·3906	64·8
1·3637	80	1·3723	74·9	1·3814	69·8	1·3908	64·7
1·3639	79·9	1·3725	74·8	1·3816	69·7	1·3910	64·6
1·3640	79·8	1·3726	74·7	1·3817	69·6	1·3912	64·5
1·3642	79·7	1·3728	74·6	1·3819	69·5	1·3913	64·4
1·3644	79·6	1·3730	74·5	1·3821	69·4	1·3915	64·3
1·3645	79·5	1·3732	74·4	1·3823	69·3	1·3917	64·2
1·3647	79·4	1·3733	74·3	1·3825	69·2	1·3919	64·1
1·3649	79·3	1·3735	74·2	1·3827	69·1	1·3921	64
1·3650	79·2	1·3737	74·1	1·3828	69	1·3923	63·9
1·3652	79·1	1·3739	74	1·3830	68·9	1·3925	63·8
1·3654	79	1·3741	73·9	1·3832	68·8	1·3927	63·7
1·3655	78·9	1·3742	73·8	1·3834	68·7	1·3929	63·6
1·3657	78·8	1·3744	73·7	1·3836	68·6	1·3931	63·5
1·3659	78·7	1·3746	73 6	1·3838	68·5	1·3932	63·4
1·3661	78·6	1·3748	73·5	1·3839	68·4	1.3934	63·3
1·3662	78·5	1·3749	73·4	1·3841	68·3	1·3936	63·2
1·3664	78·4	1·3751	73·3	1·3843	68·2	1·3938	63·1
1·3666	78·3	1·3753	73·2	1·3845	68·1	1·3940	63
1·3667	78·2	1·3755	73·1	1·3847	68	1·3942	62·9
1·3669	78·1	1·3757	73	1·3849	67·9	1·3944	62·8
1·3671	78	1·3758	72·9	1·3850	67·8	1·3946	62·7
1·3672	77·9	1·3760	72·8	1·3852	67·7	1·3948	62·6
1·3674	77·8	1·3762	72·7	1·3854	67·6	1·3950	62·5
1·3676	77·7	1·3764	72·6	1·3856	67·5	1·3951	62·4
1·3677	77·6	1·3766	72·5	1·3858	67·4	1·3953	62·3
1·3679	77·5	1·3767	72·4	1·3860	67·3	1·3955	62·2
1·3681	77·4	1·3769	72·3	1·3862	67·2	1·3957	62·1
1·3682	77·3	1·3771	72·2	1·3863	67·1	1·3959	62
1·3684	77·2	1·3773	72·1	1·3865	67	1·3961	61·9
1·3686	77·1	1·3774	72	1·3867	66·9	1·3963	61·8
1·3687	77	1·3776	71·9	1·3869	66·8	1·3965	61·7
1·3689	76·9	1·3778	71·8	1·3871	66·7	1·3967	61·6
1·3691	76·8	1·3780	71·7	1·3873	66·6	1·3969	61·5
1·3692	76·7	1·3782	71·6	1·3874	66·5	1·3970	61·4
1·3694	76·6	1·3783	71·5	1·3876	66·4	1·3972	61·3
1·3696	76·5	1·3785	71·4	1·3878	66·3	1·3974	61·2
1·3697	76·4	1·3787	71·3	1·3880	66·2	1·3976	61·1
1·3699	76·3	1·3789	71·2	1·3882	66·1	1·3978	61
1·3701	76·2	1·3790	71·1	1·3884	66	1·3980	60·9
1·3703	76·1	1·3792	71	1·3885	65·9	1·3982	60·8
1·3704	76	1·3794	70·9	1·3887	65·8	1·3984	60·7
1·3706	75·9	1·3796	70·8	1·3889	65·7	1·3986	60·6
1·3708	75·8	1·3798	70·7	1·3891	65·6	1·3988	60·5

Estimation of Water in Sugar Solutions.—*Continued.*

Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.
1·3989	60·4	1·4089	55·3	1·4197	50·2	1·4302	45·1
1·3991	60·3	1·4091	55·2	1·4199	50·1	1·4304	45
1·3993	60·2	1·4093	55·1	1·4201	50	1·4306	44·9
1·3995	60·1	1·4095	55	1·4203	49·9	1·4309	44·8
1·3997	60	1·4097	54·9	1·4205	49·8	1·4311	44·7
1·3999	59·9	1·4099	54·8	1·4207	49·7	1·4313	44·6
1·4001	59·8	1·4101	54·7	1·4209	49·6	1·4316	44·5
1·4003	59·7	1·4103	54·6	1·4211	49·5	1·4318	44·4
1·4005	59·6	1·4106	54·5	1·4213	49·4	1·4320	44·3
1·4007	59·5	1·4108	54·4	1·4215	49·3	1·4322	44·2
1·4009	59·4	1·4110	54·3	1·4217	49·2	1·4325	44·1
1·4011	59·3	1·4112	54·2	1·4220	49·1	1·4327	44
1·4013	59·2	1·4114	54·1	1·4222	49	1·4329	43·9
1·4015	59·1	1·4116	54	1·4224	48·9	1·4332	43·8
1·4017	59	1·4118	53·9	1·4226	48·8	1·4334	43·7
1·4019	58·9	1·4120	53·8	1·4228	48·7	1·4336	43·6
1·4021	58·8	1·4123	53·7	1·4230	48·6	1·4339	43·5
1·4022	58·7	1·4125	53·6	1·4232	48·5	1·4341	43·4
1·4024	58·6	1·4127	53·5	1·4234	48·4	1·4343	43·3
1·4026	58·5	1·4129	53·4	1·4236	48·3	1·4345	33·2
1·4028	58·4	1·4131	53·3	1·4238	48·2	1·4348	43·1
1·4030	58·3	1·4133	53·2	1·4240	48·1	1·4350	43
1·4032	58·2	1·4135	53·1	1·4242	48	1·4352	42·9
1·4034	58·1	1·4137	53	1·4244	47·9	1·4355	42·8
1·4036	58	1·4140	52·9	1·4246	47·8	1·4357	42·7
1·4038	57·9	1·4142	52·8	1·4248	47·7	1·4359	42·6
1·4040	57·8	1·4144	52·7	1·4250	47·6	1·4362	42·5
1·4042	57·7	1·4146	52·6	1·4253	47·5	1·4364	42·4
1·4044	57·6	1·4148	52·5	1·4255	47·4	1·4366	42·3
1·4046	57·5	1·4150	62·4	1·4257	47·3	1·4368	42·2
1·4048	57·4	1·4152	52·3	1·4259	47·2	1·4371	42·1
1·4050	57·3	1·4154	52·2	1·4261	47·1	1·4373	42
1·4052	57·2	1·4156	52·1	1·4263	47	1·4375	41·9
1·4054	57·1	1·4159	52	1·4265	46·9	1·4378	41·8
1·4056	57	1·4161	51·9	1·4267	46·8	1·4380	41·7
1·4058	56·9	1·4163	51·8	1·4269	46·7	1·4382	41·6
1·4060	56·8	1·4165	51·7	1·4271	46·6	1·4385	41·5
1·4062	56·7	1·4167	51·6	1·4273	46·5	1·4387	41·4
1·4064	56·6	1·4169	51·5	1·4275	46·4	1·4389	41·3
1·4066	56·5	1·4171	51·4	1·4277	46·3	1·4391	41·2
1·4068	56·4	1·4173	51·3	1·4279	46·2	1·4394	41·1
1·4070	56·3	1·4176	51·2	1·4281	46·1	1·4396	41
1·4071	56·2	1·4178	51·1	1·4283	46	1·4398	40·9
1·4073	56·1	1·4180	51	1·4285	45·9	1·4401	40·8
1·4075	56	1·4182	50·9	1·4288	45·8	1·4403	40·7
1·4077	55·9	1·4184	50·8	1·4290	45·7	1·4405	40·6
1·4079	55·8	1·4186	50·7	1·4292	45·6	1·4408	40·5
1·4081	55·7	1·4188	50·6	1·4294	45·5	1·4410	40·4
1·4083	55·6	1·4190	50·5	1·4296	45·4	1·4412	40·3
1·4085	55·5	1·4193	50·4	1·4298	45·3	1·4414	40·2
1·4087	55·4	1·4195	50·3	1·4300	45·2	1·4417	40·1

Estimation of Water in Sugar Solutions.—*Continued.*

Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.
1·4419	40	1·4537	34·9	1·4656	29·8	1·4782	24·7
1·4421	39·9	1·4540	34·8	1·4658	29·7	1·4784	24·6
1·4424	39·8	1·4542	34·7	1·4661	29·6	1·4787	24·5
1·4426	39·7	1·4544	34·6	1·4663	29·5	1·4789	24·4
1·4428	39·6	1·4547	34·5	1·4666	29·4	1·4792	24·3
1·4431	39·5	1·4549	34·4	1·4668	29·3	1·4794	24·2
1·4433	39·4	1·4551	34·3	1·4671	29·2	1·4797	24·1
1·4435	39·3	1·4554	34·2	1·4673	29·1	1·4799	24
1·4438	39·2	1·4556	34·1	1·4676	29	1·4802	23·9
1·4440	39·1	1·4558	34	1·4678	28·9	1·4804	23·8
1·4442	39	1·4561	33·9	1·4681	28·8	1·4807	23·7
1·4445	38·9	1·4563	33·8	1·4683	28·7	1·4810	23·6
1·4447	38·8	1·4565	33·7	1·4685	28·6	1·4812	23·5
1·4449	38·7	1·4567	33·6	1·4688	28·5	1·4815	23·4
1·4451	38·6	1·4570	33·5	1·4690	28·4	1·4817	23·3
1·4454	38·5	1·4572	33·4	1·4693	28·3	1·4820	23·2
1·4456	38·4	1·4574	33·3	1·4695	28·2	1·4822	23·1
1·4458	38·3	1·4577	33·2	1·4698	28·1	1·4825	23
1·4461	38·2	1·4579	33·1	1·4700	28	1·4827	22·9
1·4463	38·1	1·4581	33	1·4703	27·9	1·4830	22·8
1·4465	38	1·4584	32·9	1·4705	27·8	1·4832	22·7
1·4468	37·9	1·4586	32·8	1·4708	27·7	1·4835	22·6
1·4470	37·8	1·4588	32·7	1·4710	27·6	1·4838	22·5
1·4472	37·7	1·4591	32·6	1·4713	27·5	1·4840	22·4
1·4475	37·6	1·4593	32·5	1·4715	27·4	1·4843	22·3
1·4477	37·5	1·4595	32·4	1·4717	27·3	1·4845	22·2
1·4479	37·4	1·4598	32·3	1·4720	27·2	1·4848	22·1
1·4482	37·3	1·4600	32·2	1·4722	27·1	1·4850	22
1·4484	37·2	1·4602	32·1	1·4725	27	1·4853	21·9
1·4486	37·1	1·4605	32	1·4727	26·9	1·4855	21·8
1·4489	37	1·4607	31·9	1·4730	26·8	1·4858	21·7
1·4491	36·9	1·4609	31·8	1·4732	26·7	1·4860	21·6
1·4493	36·8	1·4612	31·7	1·4735	26·6	1·4863	21·5
1·4496	36·7	1·4614	31·6	1·4737	26·5	1·4865	21·4
1·4498	36·6	1·4616	31·5	1·4740	26·4	1·4868	21·3
1·4500	36·5	1·4619	31·4	1·4742	26·3	1·4871	21·2
1·4503	36·4	1·4621	31·3	1·4744	26·2	1·4873	21·1
1·4505	36·3	1·4623	31·2	1·4747	26·1	1·4876	21
1·4507	36·2	1·4626	31·1	1·4749	26	1·4878	20·9
1·4509	36·1	1·4628	31	1·4752	25·9	1·4881	20·8
1·4512	36	1·4630	30·9	1·4754	25·8	1·4883	20·7
1·4514	35·9	1·4632	30·8	1·4757	25·7	1·4886	20·6
1·4516	35·8	1·4635	30·7	1·4759	25·6	1·4888	20·5
1·4519	35·7	1·4637	30·6	1·4762	25·5	1·4891	20·4
1·4521	35·6	1·4639	30·5	1·4764	25·4	1·4893	20·3
1·4523	35·5	1·4642	30·4	1·4767	25·3	1·4896	20·2
1·4526	35·4	1·4644	30·3	1·4769	25·2	1·4898	20·1
1·4528	34·3	1·4646	30·2	1·4772	25·1	1·4901	20
1·4530	35·2	1·4649	30·1	1·4774	25	1·4904	19·9
1·4533	35·1	1·4651	30	1·4777	24·9	1·4906	19·8
1·4535	35	1·4653	29·9	1·4779	24·8	1·4909	19·7

ESTIMATION OF WATER IN SUGAR SOLUTIONS.—*Continued.*

Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.	Refractive Index at 20° C.	% Water.
1·4912	19·6	1·4943	18·4	1·4975	17·2	1·5007	16
1·4914	19·5	1·4946	18·3	1·4978	17·1	1·5009	15·9
1·4917	19·4	1·4949	18·2	1·4980	17·	1·5012	15·8
1·4919	19·3	1·4951	18·1	1·4983	16·9	1·5015	15·7
1·4922	19·2	1·4954	18	1·4985	16·8	1·5017	15·6
1·4925	19·1	1·4956	17·9	1·4988	16·7	1·5020	15·5
1·4927	19	1·4959	17·8	1·4991	16 6	1·5022	15·4
1·4930	18·9	1·4962	17·7	1·4993	16·5	1·5025	15·3
1·4933	18·8	1·4964	17·6	1·4996	16·4	1·5028	15·2
1·4935	18·7	1·4967	17·5	1·4999	16·3	1·5030	15·1
1·4938	18·6	1·4970	17·4	1·5001	16·2	1·5033	15
1·4941	18·5	1·4972	17·3	1·5004	16·1		

JAMAICA AND THE SUGAR CONVENTION.

THE GOVERNOR'S PROTEST.

The West India Committee published last month the text of an important despatch addressed by Sir Sidney Olivier, the new Governor of Jamaica, to Lord Elgin, Secretary for the Colonies, with regard to the question of the continuation of the Brussels Convention.

His despatch began by referring to several resolutions passed by Jamaica public bodies on the question, copies of which were forwarded simultaneously. He then mentioned a despatch of his predecessor, dated last October, in favour of the retention of the Convention, and stated that he wished to associate himself with its general purport. In this and subsequent despatches Sir Alexander Swettenham had dwelt on "the salutary effect on the sugar cane industry of this island of the Convention from which his Majesty's Government now intimate their intention of withdrawing."

Sir Sidney Olivier asked Lord Elgin to carefully consider the statements and arguments of the resolutions referred to, with regard to the soundness of which he thought there could be for the most part but little question. He realized that the proposed step was taken for considerations of fiscal policy independent of those indicated on behalf of the West Indies. But having himself had exceptional opportunities of learning the significance of the sugar bounty question in the West Indian Colonies, he desired to state without reserve some of his own impressions of the matter. To quote the despatch:—

When his Majesty's Government announce that they consider that the limitation of the sources from which sugar may enter the United Kingdom is incompatible with the interests of the sugar-using manufacturers, they

appear to persons interested in the West Indies and in the cane sugar industry to overlook two considerations :—

(1) That the effect of the revival of bounties and the removal of the other restrictions of the Convention will be to produce a contraction and limitation of the sources from which sugar may enter the United Kingdom, by crippling an important source of the supply of cane sugar. This argument has been sufficiently laboured by others, and I need not enlarge on it.

(2) That, presuming the interests of the British consumers and sugar-using manufacturers to be measurable in terms of price of sugar (which appears to be a reasonable interpretation of the intention of Sir Edward Grey's announcement), it is straining at a gnat and swallowing a camel to denounce the exclusion of Russian, Argentine, and other bounty-fed sugar from the British market, which cannot affect the price by more than a few pence a cwt., whilst maintaining the British import duty of 4s. 2d. a cwt., which raises the price by many times the amount that can possibly be due to the exclusion of bounty-fed sugars.

The average West Indian producer, stung in his personal interest, impatiently denounces this attitude as one of political hypocrisy, and he argues that by the time the British Government has cast the beam of the import duty out of the eyes of home politicians the magnitude of the mote of augmented price attributable to the continued exclusion of bounty-fed sugar may possible become discernible, and will be found to be an evil entirely negligible in comparison with the evils which will be produced by the abandonment of the Convention.

The special character of this evil other than the mere economic effects, I endeavoured to impress upon your lordship, in a conversation which I had with you shortly before I left England. The continued acceptance by Great Britain of bounty-fed sugar under the condition which caused continual depression to the principal West Indian industry always appeared to the populations of these Colonies a mean, unjust, and contemptible thing, and provoked alienation and impatience in the attitude of these Colonies towards the Mother-country. It had a great effect in stimulating the popularity of proposals for exclusive commercial union with the United States which could not but have resulted to the detriment of the trade with Great Britain. The action of Mr. Chamberlain in attacking the bounty system appeared to the population of those Colonies a statesmanlike, sympathetic, and, above all, an honourable and high-minded policy, and it did more than anything has done for many years past to revive British sentiment and a pride in the connection with Great Britain in these parts. The economic results in increased confidence and enterprise have already been dealt with.

It does not appear to those interested in the West Indian sugar industry that his Majesty's Government can sufficiently have weighed between the advantage of admitting the sugar of countries which still give bounties to the British market and the advantage of maintaining this stimulated confidence and enterprise in a part of the Empire which may either progress or retrogress, but which will certainly progress more assuredly if the Convention and all that it means, sentimentally as well as commercially, is maintained.

APPARATUS FOR AUTOMATICALLY SAMPLING JUICES.

By A. Arnaud.

The control of the sugar entering into the factory can be carried out in two different ways:—

1. By analysing the fresh beet or cane slices.
2. By analysing the diffusion or milled juice.

There are numerous sources of error to be considered especially as regards the weight of the original matter worked up. A homogeneous sample is difficult to procure, especially when canes are concerned. The weighing apparatus is sometimes badly adjusted, giving a plus or minus error, drying occurs in the factory yard, and to these drawbacks must be added losses through adhering soil, &c.

For these several reasons, it is important to ascertain the volume and the richness of the juice extracted and then to take these factors as the basis for determining the quantity of sugar entering into the factory. In particular must the juice be accurately measured and for that purpose one should have a graduated tank and a reliable attendant.

Here, we think that it may prove of interest to set forth the chief precautions to be taken in measuring the juice.

First of all care should be taken that the entry and exit valves can be shut tight. The float, if of wood, should be coated with oil to prevent absorption and consequent increase in weight. A metal float is however best. The link fastened to the float should preferably be of the shape of an equilateral triangle, of which one side is fastened to the plane of the float. This will prevent the chain from twisting round its attachment, such as often occurs when the link is circular. The chain should be composed of solidly welded links. Its length, including float and counterpoise, should be determined exactly by means of the gauge fitted to the bath.

The counterpoise indicator which slides along a divided scale should be attached to the chain by a swivel hook, so as to allow the length to be adjusted without disturbing the guides already fixed.

The tank is then gradually filled by adding one hectolitre at a time of water at 15°C., or by adding 100 kilos from a vessel which has been tared wet. After adding each hectolitre the remaining capacity of the bath is calculated and the figure marked on the scale where the counterpoise stops.

Ascertain frequently that no link of the chain has got twisted, and that the chain itself preserves its original length. Take note of the position of the stirrer and of the juice delivery-pipe and also their volume, in case their contents go to add to the amount of the juice treated, the apparatus in different usines varying in details.

Prevent the float from resting on the bottom of the tank when the latter is emptied, as it will not stand the strong eddy which inevitably accompanies the subsequent filling of the bath. This can easily be accomplished by passing the chain through a guide and fastening to one of the links a rubber ring of a larger diameter than the orifice of the guide, whereupon the float can be adjusted to remain suspended about 20 inches above the bottom of the tank. The chain will then be quite safe from getting twisted. Finally calculate the volume of the juice passing out at a temperature of 15° by means of Rosetti's tables.

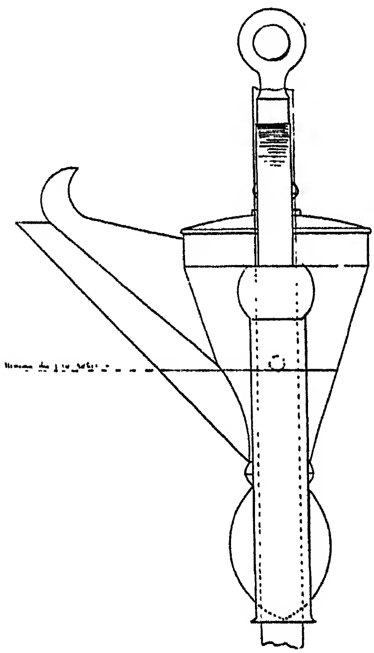

FIG. 1.

By observing the precautions indicated above and with a little care and attention during the process of manufacture, one can rest assured that the measuring of the juice is proceeding satisfactorily. A controlling apparatus, such as Horsin-Deon's, naturally gives more exact indications when errors are suspected, but it is not absolutely indispensable if one can depend on the attendant at the measuring tank.

It remains then to discuss the question of sampling the juice. This requires great care, and is too delicate a task to be entrusted to any other person than the chemist.

The diffusion juice is easily affected if brought into contact with a dirty spiral cooler or gauge, or a densimeter that is kept in a receptacle where the water is not frequently changed. And it is necessary to use steam or boiling water to destroy the ferments or else employ strong antiseptics. Apart from that, there are forgotten samples, and samples which though not forgotten are not used. And yet the sugar varies in each 100 cc. of the tank, and if we desire a rigorously exact average, all these drawbacks must be overcome. In many cases it is the attendant told off to measure the juice who also collects in a flask the samples for the laboratory. Relieve him of this additional task and then he will give more attention to his principal work and discharge it all the better.

Of what use are saccharimeters, calibrated flasks, or even a conscientious chemist, if the sample he receives is faulty and introduces into his chemical control an error which will amount to as much as several sacks of sugar in the course of 24 hours?

It is then practically impossible to know in the process of manufacture whether the yields and the losses are normal, and to ascertain with any accuracy the undetermined losses, if any.

We must therefore turn to the automatic apparatus to solve our difficulty. Those patterns which already exist are well known and will not be referred to here. The writer has, however, designed a new apparatus which combines simplicity of construction with regularity of work. Its chief characteristic consists in the absence of taps and the small quantity of juice taken each time, to wit, 25 or 30 cc., which permits the collecting of the samples during a working day of 12 hours in a bottle holding no more than 1½ litres (in which it is best to place 3 cc. of an alcohol or ether solution saturated with mercuric bichloride).

The details of this apparatus are as follows:—

Inside the measuring tank, about 15 c. from one side, two straight and parallel rods about 15 mm. in diameter are placed, 13 c. apart, standing vertically about five-sixths of the height of the bath. They are secured at the bottom to pieces of T iron and at the top to somewhat similar fittings, only in this case made to unfasten and allow the rods to be removed as required. At the top of the tank and proportional to its width is placed a cross-piece of iron carrying two small pulleys and two guides. These two pulleys are worked by a chain, to one end of which is attached the float, while to the other is secured our automatic burette, which slides up and down between the two rods.

On the inside of the tank and at a convenient height above the drawing-off level is fastened a copper funnel (B, Fig. 3) of a particular design, arranged to limit the travel of the measuring burette and at the same time to receive the sample of juice, which is

immediately passed into the bottle holding 1½ litres. This is placed outside the tank on a suitable shelf enclosed inside a small cupboard.

By means of a ring fastened to the chain the descent of the float is retarded beyond a certain point so as to keep it suspended 40 or 50 c. above the bottom.

The burette is constructed of copper in the shape of a conical dispensing glass, of which however the foot is replaced by an oval mass of metal to give stability to the whole.

A round spout (*f*, Fig. 2) serves to discharge the juice. The burette is closed by a lid which is secured by a small bolt (*g*).

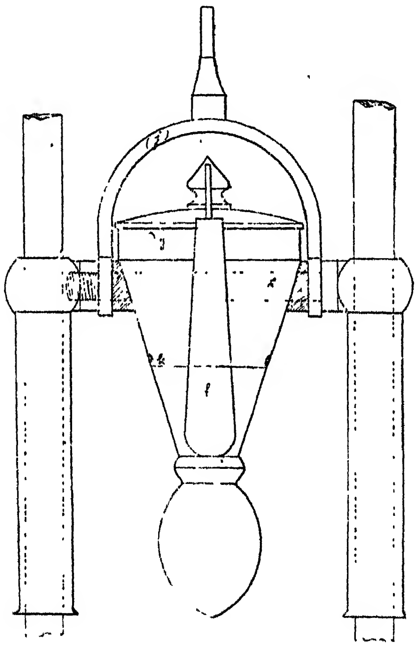

FIG. 2.

A spindle 10 m. in diameter supports the burette and serves as its pivot. At each end of this spindle is a vertical tube (*i*) about 18 m. internal diameter. These two tubes slide up and down the rods already mentioned. A horseshoe handle connects this apparatus to the chain attached to the float. Two small drain holes (*k*) allow any excess of juice to escape and no more than 25 to 30 cc. remain in the burette to go to form the sample.

The working of the apparatus is as follows:—

The tank being empty, the burette is in contact with the funnel

and in an oblique position as shown in Fig. 1, the float being about 50 cm. above the bottom of the tank.

As soon as the entering liquid reaches the float, the burette commences to descend and plunges into the juice. The latter enters through the several openings. Under the lid of the burette exists a layer of air which escapes slowly in bubbles out of the holes

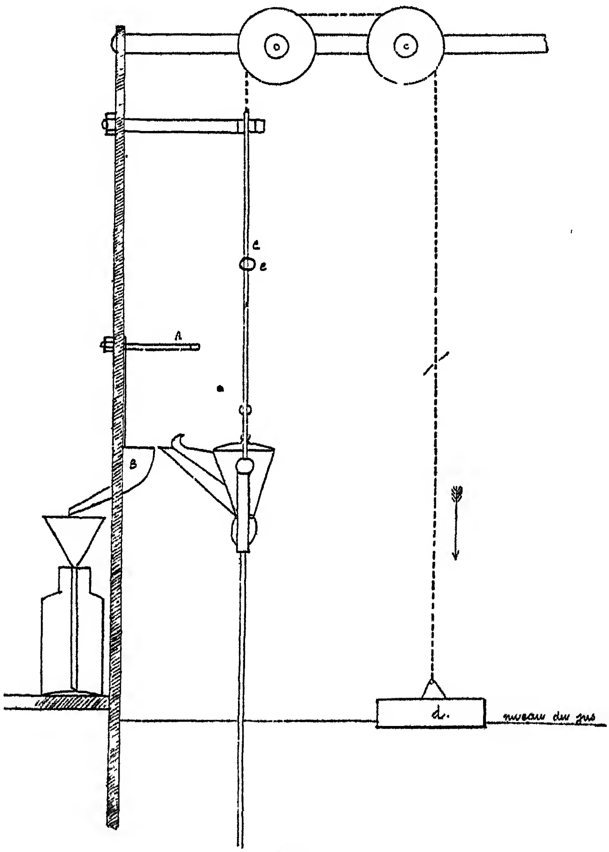

Fig. 3.

through which the bolt (*g*, Fig. 3) passes. The juice therefore enters the measure very gradually and is taken from different depths of the liquid in the tank; this is a point of no small importance. As soon as the tank is full, it is emptied again, whereupon the float, which is heavier than the gross weight of the burette and sample, sinks and draws the burette up once more. On the latter emerging

from the liquid, the excess of juice escapes from the two openings (*k*, Fig. 2) and the remaining sample while still hot is tipped into the copper funnel owing to the burette coming into contact with the projection (A, Fig. 3). After this the whole process is repeated for the next sample.

It will be seen that this automatic burette is not liable to go wrong. The loose pulp never penetrates into it, the small openings acting as a strainer. And, as M. Pellet has pointed out, it would be very easy to add a metal cloth to envelop the whole if any trouble were feared on this score.

It may be added that this apparatus, fitted to four measuring tanks in a cane sugar factory in Egypt, has worked during the whole campaign 1906-07 without any breakdown. One cleaning per week was found sufficient, and as the whole arrangement is easily taken to pieces, there is no time lost in the task.

With this apparatus we have obtained each day a perfect and well-preserved sample with which we have been able to carry out tests for density, sugar, reducing matters, &c., with all the precision desired, and to obtain therefrom information of great value for our chemical control and the working of the factory.

We trust that this apparatus may be employed in beet and cane factories and distilleries, and, in short, in all those industries where liquids are measured by variations in level and where it is necessary at each operation to take a true sample.—(*Bulletin des Chimistes.*)

SEEDLING CANE EXPERIMENTS IN BARBADOS, 1904-06.

The experiments with seedling and other canes, as carried out in Barbados during the season 1904-06 under the superintendence of Professor d'Albuquerque and Mr. J. R. Bovell, form the subject of a recent pamphlet (No. 44) issued by the Imperial Department of Agriculture in the West Indies.

During the nine years that the Imperial Department has been in existence some 30,000 canes have been raised from seed, and have been studied in the pot, in the field, and in many instances also in the chemical laboratory, in order to select and afterwards propagate varieties which possess the most desirable agricultural and chemical characters. The means by which these objects are attained are worth setting forth, and are briefly as follows:—

The majority of seedlings are raised from seed planted early in the year in boxes and afterwards potted: the better specimens (generally some thousands in number) are planted in May in a field arranged for irrigation, so that during their more tender period they can be

protected from drought if necessary. They are kept under careful observation during their growth, and when they come to maturity in the March or May of the following year those varieties whose agricultural qualities are good enough are reaped and analysed. The whole stool is cut, weighed, and crushed, and if the chemical analysis shows that the juice is rich and pure, the stools are irrigated to induce a spring of ratoon canes to provide plants for multiplying the variety the following December. From that time the variety is annually propagated and multiplied in the usual manner, and if the results warrant it is grown in an increasing number of plots in different districts both as plants and ratoons. Each year these plots are reaped and weighed, samples of the canes are crushed in a small estate mill at the laboratory, and the juice is analysed, and this goes on until the cane is either ultimately rejected or plants are supplied to the planters with the recommendation to try them on a small estate scale.

Among the tables given in this report an interesting one is that which shows the average sugar yield of the chief varieties on black and red soils (plants and ratoons) for the years 1900-1906.

In black soils the following plant canes were best:—

	Saccharose. Lbs. per acre.	Muscovado Sugar. Lbs. per acre.	Increase in value per acre compared with White Transparent.
B. 1529	8,223	6,578	17·64
B. 147	7,042	5,634	5·37
B. 208	6,939	5,551	4·29
White Transparent.	6,526	5,221	—

In red soils better results are found:—

B. 1566	9,314	7,451	39·64
B. 1529	7,750	6,200	23·37
B. 208	6,802	5,442	23·52
B. 376	6,620	5,296	11·62
D. 95	6,215	4,972	7·41
White Transparent.	5,503	4,402	—

In average results of both plants and ratoons on red soils B. 1566 was at the top. It is to be noted that the seedlings 1529 and 1566 have only been in cultivation for three years and in few plots, whereas the older seedlings have been cultivated over the whole period and in many plots. Apart from this, however, they seem to promise well, and if their decided superiority to older seedlings like B. 208 is sustained, they should prove of considerable value. It is, however, the test of time that is the real criterion in appraising their permanent value as sound varieties, and their future should be watched with some interest. B. 208, it is to be noted, while still in the first rank no longer takes premier place; in the results for 1905 it is only sixth on the list, as the following table will show.

Results of plant canes on black soils:—

	Saccharose.		Muscovado Sugar.		Increase in value per acre compared with White Transparent.
D. 95	9,216	..	7,373	..	24·34
B. 1529	7,968	..	6,374	..	11·35
B. 147	7,640	..	6,112	..	7·94
D. 1438	7,413	..	5,930	..	5·58
B. 376	7,387	..	5,910	..	5·32
B. 208	7,287	..	5,830	..	4·28
White Transparent.	6,876	..	5,501	..	—

It will thus be seen that a Demerara seedling heads the list with very good figures.

On red soils B. 1566 has done best with 9,811 lbs. of saccharose for plant canes, being an increased value of $47·30 over White Transparent.

The following description of a few of the canes concerned may prove of interest:—

B. 208.—Germinates readily; from 10 to 15 canes per clump; internodes from three to five inches long, somewhat cylindrical; colour greenish yellow; habit upright; average number of arrows; the dry leaves have a tendency to adhere.

B. 1529.—Germinating power somewhat under the average; 15 to 22 small canes to the clump; internodes from two to six inches long, are variable, some being cylindrical, others tumid; colour red; habit upright; does not arrow readily; leaves somewhat adherent.

B. 1566.—Germinating power fairly good; seven to twelve large canes to a clump; internodes two to six inches long, cylindrical or slightly tumid; colour yellow; habit recumbent; flowers freely; dry leaves have a tendency to adhere; eyes large.

D. 95.—Germinates readily; from twelve to fifteen canes to the clump; internodes from two to six inches long, somewhat tumid; colour dark red; habit upright; arrows freely; dry leaves have a tendency to adhere; eyes large and prominent and liable to be broken off.

The Colonial Sugar Refining Co., Ltd., of Sydney, have been considering a proposal to increase their capital to £2,500,000 by means of an issue of £300,000 in £20 shares. This extension has been rendered necessary in order to meet the purchase of Messrs. Poolman's business and other matters.

The revenue from sugar, as given in the Customs returns for the United Kingdom for the year ending March 31st last, amounted to 6¼ million pounds sterling.

REPORT OF THE TARIFF COMMISSION ON SUGAR.

Summary of Evidence and Statistics.

In our last issue we briefly set forth the facts which have been elucidated by the Tariff Commission with regard to the sugar industry. We now give in abridged form the analysis and summary of evidence supplied to the Commission by the witnesses examined. The report states that this summary has been compiled on the basis of the actual statements of the witnesses, and no comment of any kind is added by the Commission. Verbatim reports of the statements of the witnesses are also published, but we must refer those of our readers, who desire to study them in detail, to the official publication of the Tariff Commission.*

The British Refining Industry.

At present the chief centres of the sugar refining industry in order of their importance are London, Liverpool, Greenock. There were formerly refineries in Bristol, Leith, Manchester, Goole, and elsewhere. The evidence shows the gradual diminution of the sugar refining trade generally. Fifty years ago the consumption per head of the population was about 29½ lbs. By 1885 it had increased to 79½ lbs., and last year to 95¼ lbs. But whereas 50 years ago practically the whole of the sugar consumed was refined in this country, in 1885 only 77% was refined here, and in 1905 only 45%. The imports of raw sugar to be refined here have decreased from 19½ million cwts. in 1885 to 12½ million cwts. in 1903. Since then when the Convention came into operation there has been an increase to 15¼ million cwts.

No doubt is expressed by the British refiners who gave evidence as to the capacity of British refineries to supply the whole of the British demand for refined sugar. But a specific illustration of the decline that has taken place in our refining industry is given by the case of Greenock. In 1883 this town melted 260,000 tons, while in 1906 only 188,000 tons were dealt with, and in 1903 the amount was as low as 108,000 tons. In the year 1884 there were 14 refineries in Scotland; at present only six remain. As an instance of the depression which has existed, a fully equipped refinery which originally cost about £140,000 was several years ago sold for £20,000. Greenock has many advantages for carrying on this branch of the industry, such as abundant supplies of water, close proximity to coal fields, ample dock accommodation, extremely low charges for landing sugar.

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Practically all the refined sugar which we import comes from the beet-growing countries of Europe, and the imports have increased from 6¼ million cwts. in 1886 to 18 million cwts. in 1906, an increase of 180%. The chief sources of supply are Germany, Holland, and France.

The comparative prices of the imported and home-refined sugar are stated thus in the evidence by a Liverpool firm of refiners: "So-called 'first marks' sugar for import into Great Britain was in 1904 bought at about 9s. 10d. f.o.b. Hamburg. The cost of production is 9s. for the raw sugar (taking the roots at their minimum value), plus about 2s. 6d. for the cost of refining—total 11s. 6d. per cwt. Hence German refined sugar was sold in this country at a price 1s. 8d. per cwt. below the cost of production. Countries adhering to the Brussels Sugar Convention have been allowed to give native refined sugar a protection of six francs per 100 kilos. (nearly 2s. 6d. per cwt.) in their home markets. In consequence, the surplus that they cannot consume, caused by the recent enormous over-production, has been sent to Great Britain and sold at a price below the cost of producing similar sugar in this country. The sugar refiners of the United States have so profitable a protection in their home market that they can 'dump' their by-product syrup into Great Britain. British refiners have to meet this competition by parting with their syrup at unremunerative prices." A Greenock firm reporting on July, 1907, says: "Prior to the coming into operation of the Sugar Convention refined sugar was placed on this market greatly below cost of production. The six francs surtax allowed by the Convention still affords possible facilities to the Continent for the export of refined sugar under cost of production, but while Continental producers no doubt are favoured to some extent by their position in this respect, the original attempt which was recently made to utilize the surtax for an official Kartell has for the time being broken down. Refiners in this country are, however, still suffering from the unnatural competition of refineries called into existence on the continent during the bounty period, and we believe in many cases refined sugars are consequently sold here under cost. Four years has been too short a period to altogether restore the trade to a natural basis, after almost 50 years of artificial trading." Since 1886 the population of the United Kingdom has increased 20%, and there has been a greatly extended use of sugar. Nevertheless the imports of raw sugar for refining purposes have declined from 17 million to 14 million cwts., or 18%. Since the Convention there has been an appreciable increase in the importation of raw sugar.

Raw beet sugar has come almost entirely from Germany throughout these 20 years. The chief sources of raw cane sugar are set out in the following summary table:—

IMPORTS INTO THE UNITED KINGDOM OF RAW CANE SUGAR
(In thousand cwts).

	1886.	1896.	1901.	1906.
Java	3,909	1,148	209	358
Philippines.*	578	1,403	50	112
British West Indies	646	766	683	1,265
British East Indies..	877	1,620	175	251
All Foreign Countries	6,213	4,576	1,833	2,299
All British Possessions ..	3,249	3,104	1,545	1,967
Total	9,462	7,680	3,378	4,266

The importation of molasses has increased six times in the last 20 years, and was in 1906 2,656,000 cwt., the largest single supply coming from the United States. The imports of glucose have nearly trebled in the same period, and practically the whole of the present supply (1,457,000 cwt.) is obtained from the United States. The nature of this importation is thus explained by a firm of glucose manufacturers: "We experience foreign competition in glucose, which is used largely by confectioners, jam manufacturers and brewers, and in golden syrup. There is a very large consumption of glucose in America. The duty on English glucose exported to America is 9s. per cwt. The duty on American glucose coming to England is 2s. 9d. per cwt. The American manufacturers are thus protected in their home trade to the extent of 6s. 3d. per cwt., and, having this protection, are enabled to keep their factories working night and day, knowing that they may at any time 'dump' their surplus in this country regardless of cost. The effect is that they obtain from their own consumers very high prices, probably two or three pounds per ton more than they take in England, and although we can and do make glucose as cheaply as the Americans, yet they do sell in England at prices actually below our cost. We should charge the foreign manufacturer the same duty that he charges us."

The chief concern of the British sugar refiner is the home trade. Taking the last five years we find that about three-quarters of a million cwts. of refined sugar was exported, while the home trade absorbed the balance of 32,000 000 cwts. which was the total of raw and refined sugar imported in the same period. There was of course no native sugar, and to the exports must be added some undefined figure for the sugar entering into the exports of sugar goods. Prior to 1900 pickles, vinegar and sauces were classed in one and the same group as chocolates, confectionery and preserved fruits.

The lowest point in the export of refined sugar was reached in 1901, and witnesses point to the increase of 340,000 cwts. between 1901 and 1906 as evidence of one of the effects of the Convention and the cessation of German, French, Austrian and Belgian bounties. The largest of our markets for refined sugar is now Canada, which in

* Including Spanish West Indies.

1906 took 288,000 cwts. of a total export of 897,000 cwts. This total compares with 28,000 cwts. in 1897 and 29,000 in 1902. The British East Indies came next with 210,000 cwts. The exports to foreign countries have declined considerably, namely, from 898,000 cwts. per annum in the five years ending 1896 to 291,000 cwts. during the five years ending 1906. Denmark is at present the largest foreign market.

Ten years ago the United States took 25% of our total exports: the trade has now almost entirely vanished. The British loss of the United States market has synchronised with the development of the sugar-refining industry in the United States and the encouragement by preferences of the supply of sugar to that country from the Philippines.

Competing Foreign Industries.

The sugar industries of Germany, Austria-Hungary and France, are those which at present chiefly affect the sugar industry of the United Kingdom. The development of the industry in each country has been very large, and in 1901 the sowings of beet reached a maximum.

Germany.

Germany's area under beet in the early eighties was a little over 400,000 acres; in 1883 800,000 acres, and in 1905 it had attained to 1,156,000 acres. The 1881 crop was 123 million cwts., and that of 1905 302 millions. The maximum was reached in 1901 with 315 millions.

The sugar industry of Germany has quadrupled in the last 25 years. She is practically self-supporting in respect of sugar, her imports being insignificant, and never having exceeded 120,000 cwts. Of the exports about three-fourths go to the United Kingdom. The maximum was reached just before the Convention and amounted to 14 million cwts. The German exports to all countries were 14,600,000 cwts. in 1905, of which 57 per cent. was refined. This compares with 21,400,000 in 1901, of which 57 per cent. was refined. The Canadian surtax on German goods, acting in conjunction with the Canadian preference in favour of the British cane-growing colonies, has completely destroyed the German exports of sugar to Canada. Between 1894 and 1902 the German trade with Canada had increased from 270,000 cwts. to 1,437,000 cwts. In 1903 there was an immediate fall to 294,000 cwts., and in 1905 the trade had vanished. Next to the United Kingdom, Germany's most important export market was the United States, and in 1897 the latter took one-third (7,405,000 cwts.) of Germany's exports. In 1905, however, only 176,000 cwts. were taken. The United States sugar-growing colonies have made up the difference.

Austria.

In Austria the area under beet has grown from less than half-a-million acres in 1885 to over 900,000 acres in 1905, while the crop raised has increased from 62 to 191 million cwts. The sugar produced in 1905-06 was 26 million cwts., an increase of nearly 40 per cent. since 1894-95.

Imports of sugar are insignificant. Over 40 per cent. of the exports goes to the United Kingdom. In 1903 it amounted to 8 million cwts., while in 1905 it had fallen to 4,740,000. Since the Convention came into force there has been a large decrease in the exports of refined sugar to the United Kingdom, and an increase of raw sugar.

France.

Prior to the Convention the general tendency in France was towards an increased exportation of raw sugar while the refinery industry remained more or less stationary. These characteristics are attributable to the particular form of the French sugar bounties which were designed to encourage sugar production rather than refining.

The area under sugar beet cultivation reached its maximum in 1901 and was then 837,000 acres. The yield of beet was 177 million cwts., or about 11 tons per acre, which compares with the German average yield of 13½ tons per acre in the same year. In 1883 the yield was 14 tons per acre over an area of 640,000 acres; the German yield in the same year was 11 tons per acre. The sugar produced in France also reached a maximum in 1901-02 and was then 20,700,000 cwts. Twenty-five years ago it was 5,600,000 cwts. Under the operation of the Convention the production declined to 11,100,000 cwts. in 1904-5, though it recovered to 18,100,000 cwts. in the following year.

The imports into France consist almost entirely of raw sugar and molasses and have steadily declined in the last 25 years. They were 5,300,000 cwts. in 1880; this rose to 8,500,000 in 1885; with fluctuations this total has fallen to 1,600,000 cwts. in each of the years 1904 and 1905. The French exports of refined sugar have remained practically stationary during the last 25 years at between 2½ and 3 million cwts., but there was a spurt in the years 1901-1902 when the total reached 3¾ million cwts. Raw sugar exports have fluctuated considerably, reaching a maximum in 1901 of 9¼ million cwts.; in 1905 they were 3 millions. In 1905 eight-ninths of the raw sugar and rather less than one quarter of the refined sugar was exported to the United Kingdom. British purchases of French raw and refined sugar were 3,300,000 cwts. in 1905 as compared with about 8¾ millions in 1900 and 1901. Ten years ago it was 2,900,000; twenty years ago it was 1,000,000. The increased trade with the

United Kingdom in twenty years has therefore been more than 200 % and the rapid fall since 1901 synchronised with the operation of the Convention.

Belgium.

Belgium's sugar industry has doubled within the last 25 years, and in 1905 comprised 176,000 acres, producing 46 million cwts. The refiners now use nearly seven times as much raw sugar as they did twenty years ago; in the five years ending 1905 their output averaged 2,300,000 cwts. The maximum of exports was reached in 1900, when the total was nearly 6 million cwts. More than one-half of the Belgian exports come to England.

Russia.

Russia's area under sugar beet is 1,330,000 acres, yielding in 1905 155 million cwts. of beets. In 1880-81 the production was 4 million cwts.; in 1890-91 it was 9,150,000 cwts.; in 1901 15¾ million cwts., and reached a maximum of 20¾ million cwts. in 1902-03. The Russian supply available for export is however very uncertain, and in the maximum year if the whole of the surplus available for export came to the United Kingdom, it would satisfy only 12½ per cent. of the total requirements of the United Kingdom. In 1905 the Russian surplus available was only about 3 per cent. of these requirements.

BRITISH COLONIES AND POSSESSIONS:

The British West Indies.

Barbados produces three-eighths of all the sugar produced in the British West Indies. The production of Trinidad is from one-third to one-fourth of the whole, and Jamaica now produces less than one-sixth.

Practically the only markets are Canada, the United Kingdom, and the United States, this being the order of their present importance. So recently as six years ago (*i.e.*, 1900) the order of importance was the exact reverse. In 1890 Canada imported only 116,000 cwts. of sugar from the British West Indies and British Guiana; the importation of 1905 reached 2¼ million cwts., an increase of 2,100,000 cwts. In the same period the exportation to the United States fell from 3,300,000 to 1,100,000 cwts., a decrease of 2,200,000. In other words the trade was practically transferred from the United States to Canada under the double influence of the Canadian preference in favour of the British West Indies and the United States preference in favour of its possessions.

The Canadian duty is 31½ cents for 100 lbs. (1s. 5½d. per cwt.) under the Preferential tariff as compared with 52 cents (2s. 5d. per cwt.) under the General tariff on sugar not above No. 16 Dutch standard. The United States admits Porto Rican sugar free of duty. Cuban sugar receives a rebate of 20 per cent., while Philippine sugar is

allowed a rebate of 25 per cent. and a further rebate equal in amount to the export duty levied in the Philippines on sugar. This export duty is at present 5 cents ($2\frac{1}{2}$d.) per 100 kilos. (about 2 cwts.).

The exports of sugar to the United Kingdom from the British West Indies, British Guiana, and Mauritius steadily fell until the last few years, the fall being attributed to the difficulties of competing with the bounty-fed product of Europe. The average imports into the United Kingdom for the five years ending 1891 were 1,942,000 cwts. per annum; in the five years ending 1901 the annual average was 1,088,000 cwts., a fall of 854,000 cwts., or 44 per cent. In the five years ending 1906 there has been an appreciable recovery, the average being 1,449,000 cwts., an increase of 361,000 cwts., or 33 per cent. on the previous five years.

The action of the United States in countervailing the Continental bounties gave a great stimulus to the West Indian sugar exports to that country and did much to compensate the British West Indies for the decline of their British trade. The West India Committee asserts that it is only by reason of the act of a foreign power, to wit, the United States, that the West Indian sugar industry was able to survive the bounty period. By countervailing the bounties the United States provided a market in which West Indian sugar could compete on equal terms with beet. The later Kartell bounties were not, however, countervailed. At the present moment the United States only require about 300,000 tons of non-preferential sugar to make up their sugar supply, and this quantity is being rapidly decreased by their own internal beet production, by cane sugar from Porto Rico, and the extension of cultivation in Cuba and the Philippines in consequence of preferential treatment.

In the nine years ending with 1903 (June 30th) the average annual imports into the United States of sugar from the British West Indies and Guiana were 3,400,000 cwts. per annum. In 1904 the imports suddenly fell to 1,240,000 cwts., and in 1906 they fell further to 79,000 cwts.

As already indicated, the Canadian preferential tariff has been of considerable benefit to the West Indian industry, and in the words of the West India Committee "sufficiently explains why so little West Indian sugar has come to Great Britain." The Committee adds: "Canada has, however, established an Intermediate Tariff by which she hopes to secure reciprocity with other countries, and this will diminish the benefit which at present accrues to the West Indies. Moreover the consumption of sugar in Canada has not yet reached the figure of the West Indian production and she has recently extended the British preferential treatment to a limited quantity of beet sugar."

The general effect of the Convention on the West Indies has been to restore credit and to enable the sugar estates to begin to make up

the ground lost under the bounty-fed competition of Continental countries. In British Guiana the value of the sugar machinery imports rose from £32,000 per annum in the four years before the Convention to £60,000 in the four years after the Convention. During the years 1904-06 one firm alone spent £86,400 in machinery and another £38,400. In Trinidad, besides the general rehabilitation to cultivation and improvements and renewals in the factories, as well as the installation of steam ploughing and the process of extraction, a considerable development of cane farming took place. Two central factories were erected in Antigua, and in Jamaica two central factory schemes have assumed practical shape.

Canada.

There has been some sugar beet cultivation in Ontario and the Canadian North-West, but the results have so far been slight. As yet, Canada is mostly concerned with the manufacture of refined sugar, chiefly cane imported from the British West Indies and British Guiana. There are four refining factories, each with a capital of £200,000, and the product from these factories was valued at £3,335,000.

The importations have greatly developed under the operation of three main factors. (1) The United States preference to its Colonies, which tended to close the United States market to British West Indian sugar, (2) the Canadian preference to British Colonial sugar, which gave the British cane-growing Colonies an alternative market upon which (3) the Canadian surtax on German goods enabled the British cane-growing Colonies to increase their hold. From 116,000 cwts. in 1900 Canadian sugar imports from the British cane-growing Colonies became 2,246,000 cwts. in 1905. In the same period the United States importations from the British West Indies and British Guiana declined from 3,301,000 cwts. to 1,123,000—thus indicating that the supply was transferred from the United States to the Canadian market under the double operation of the Canadian Preference in favour of the British West Indies on the one hand and the United States Preference in favour of the United States Colonies and against the British West Indies on the other hand.

The Ontario Government has since 1901 pursued a policy of encouragement of sugar beet production and manufacture. The Ontario Act of that year allotted to the manufacturer a bonus of one-half per cent. per pound for all first-class marketable sugar produced during the first and second years' operation of the factory, and of one-quarter cent. per pound for the product of the third year, and nothing for any year thereafter. The Dominion Government also assisted by allowing machinery for the sugar industry to be imported free of duty. Factories were established at the following places in Ontario:—Dresden, Wallaceburg, Berlin, and Wiarton. In

the first year about 130,000 cwts. of sugar was produced. The production of 1903 was about the same. In 1904 some financial difficulties arose, but the two remaining factories produced 110,000 cwts. In the 1905 report of the Ontario Agricultural College it is stated that the acreage supplying beet to these two factories was 10,700 acres from 3,200 growers. There is said to be some export of beets to Michigan factories.

Remedial Measures.

The testimony of the evidence generally is unanimous that the condition of affairs before the adoption of the Convention required remedial measures. The Convention was received with satisfaction and here again the testimony is unanimous that its effects have been highly beneficial to the British sugar-refining industry. The Convention gave countries which were parties to it the choice between prohibition of bounty-fed sugar and countervailing duties. The general trend of the refiners' evidence reviewed in this volume is in favour of countervailing duties rather than prohibition which was the system adopted under the Convention. One witness states the reasons for this proposal in the following way:—"As a matter of equity if 2s. 6d. per cwt. was deemed by the framers of the Convention to be a fair surtax allowed to the foreigner it would only be fair to grant a like preference to British refiners. At the same time less would be sufficient to very quickly restore the trade to this country, say £1 per ton surtax on foreign refined sugar—that is to say the excise should be £1 less than the Customs rates. The effect of this surtax would not ultimately be to raise the price to the consumer. No doubt the first effect would be to raise values by something less than this £1 per ton which would not amount to one-tenth of a penny per lb., but very soon increased capital would be invested in the trade and the home refiners enabled to overtake the demand and to supply all that is now derived from the foreigner. When that point has been attained the price will have fallen to its natural level and the result of the whole policy will be that the consumer will pay no more for his sugar, £1,500,000 will be spent in the country which now goes out of it, and the home refiner will find his profit through working at three times his present capacity and thereby greatly lessening his expenses."

The general opinion expressed in the evidence is that a preferential arrangement which would make possible the development of a larger sugar production within the British Empire would be widely beneficial and that the British Government should have such powers as would enable them to conclude arrangements of this kind with the different parts of the Empire. The importance of Preference is strongly brought out both in the evidence and in the statistics where it is shown that (1) under the influence of bounty-fed sugar the British cane-growing Colonies lost a large part of the British market and

were driven to find a new market in the United States; (2) under the United States preference for Cuba and the Philippines the British cane-growing Colonies lost nearly the whole of their United States market; (3) under the Canadian Preference the British cane-growing Colonies once again secured a large sugar market within the British Empire replacing the lost market in the United States; and (4) since the adoption of the Convention the exports to the United Kingdom of sugar from the British cane-growing Colonies have tended to increase and it is the belief of witnesses that under a mutual preferential system for the whole Empire this tendency would be greatly accelerated.

The importance of continuity of policy and the ill effects of frequent changes are also dwelt upon in the evidence. One witness says on this point:—"If there were an assured policy somewhat on the foregoing lines and if the British sugar industry ceased to be the sport of party politics we might reasonably look forward to two important developments. In the first place there is good ground for anticipating the extensive cultivation of sugar beet in agricultural England, and British refiners would, I believe, be ready to put capital into the enterprise if, as I say, some continuity of State policy were assured. In the second place there are inexhaustible potential supplies of cane sugar in the West Indies, especially Cuba, and Java, and elsewhere which would be developed under the stimulus of a continuous and reasonable British fiscal policy. This would obviously involve large purchases of sugar machinery from British manufacturers and both directly and indirectly bring great benefit to British labour."

QUEENSLAND SUGAR LABOUR.

With the recent departure of some 740 farm labourers to Queensland to work on the plantations there, some correspondence has arisen in the press on the question of their ability to carry out the work they have signed on for. One or two Colonial writers have expressed grave doubts as to the possibility of their succeeding, and one such communication to the *Times* has drawn forth the following letter from the Agent-General for Queensland in London:—

QUEENSLAND SUGAR LABOUR.

To the Editor of the Times.

Sir,—In *The Times* of the 9th inst. you published some excerpts from a letter written by a correspondent in Melbourne which seems to unfairly discourage emigration generally.

Your correspondent "notes that the Immigration Department in London very wisely discouraged British labourers from going to Queensland." If by this is meant the Emigrants' Information Office, I can assure you I got material assistance from them, though in regard to sugar work north of the

Tropic of Capricorn, their information and advice was not in complete harmony with mine.

Again, "the heat is almost unbearable and only fit for black labour;" standing alone this is very misleading. I can hardly conceive any person able to assert this is a fair description of the far-famed Darling Downs. The climate there is unquestionably temperate; but, as every one knows within the tropics, it is often hot, but never unbearable; it is often exceedingly hot in London.

Again, "from the sugar-growing districts of Queensland to the northern territory is purely a black man's country." I cannot imagine what the writer intended to convey, but if he meant that from the southern limit of the sugar-growing districts of Queensland to the northern territory of South Australia it is only fit for occupation by black men, then he includes necessarily Mount Morgan, Charters Towers, Ravenswood, Croydon, Herberton, Etheridge, Cloncurry, and almost the entire mineral district of Queensland, and will find himself at variance with the thousands of white people who live there in comfort. I opine, however, that the last paragraph contains the *crux* of his letter, in which he discourages the employment of British labour in the cane fields of Queensland because it is degrading to white men. Recently for this class of work 741 young single farm labourers have gone to Queensland, to each of whom I gave the information that "there was a difference between ordinary sugar farm work and the rougher kind of sugar operations, such as harvesting cane; that a sober man with a good constitution would find no difficulty in doing the former, and that the cane was generally cut by piecework, by acclimatized hands, and a higher wage paid therefor; that in moist localities harvesting was trying to new-comers in the height of summer, but the work was neither degrading nor difficult, and the men engaged in this industry were healthy; that over 34 per cent. of the cane in Queensland was grown and harvested without the aid of black labour, a fact in itself supplying the answer to the question whether, so far as climatic conditions are concerned, white labour could be performed on sugar farms within the tropics."

I admit there is some controversy as to whether, in competition with other countries employing black labour, sugar can be economically produced by white labour alone. The Commonwealth recognize this by their bounty and Excise, but I have never heard the work on the sugar farms characterized as degrading any more than is the employment of white stokers on British men-of-war or on our ocean liners*—an occupation carried on in more confined spaces, and often in hotter localities than in that of the sugar farms on the coast of Queensland.

Federated Australia has decided that it cannot suffer the employment in any industry of a servile race unfit to be admitted to all the privileges of citizenship. Queensland, recognizing this decision, and at the same time valuing its sugar industry, preferred to substitute British labour, and has succeeded in attracting it from here.

* The comparison with stokers does not strike us as altogether fair. The latter seldom work more than four hours at a stretch when it is really hot, and when they come up from their work they encounter the comparatively cooler sea-air which is bound to be much more recuperative than is the malaria-infested climate in which sugar canes often thrive.—(Ed., *I.S.J.*)

Every emigrant was made aware of the precise conditions of his employment, and if it should result that the work imposed is beyond his power there are many other avenues there open to him; evidently he took this view. One fact is quite certain—that he was fully informed by my department of all the conditions of his employment and willingly accepted the responsibility.

Yours faithfully,

HORACE TOZER,

Agent-General for Queensland.

1, Victoria Street, S.W., Aug. 11.

But the following communication to the *Pall Mall Gazette* from the pen of an Australian gives a different view of the case and certainly suggests that Queensland is very far from having solved her labour difficulties by importing British white labour:—

QUEENSLAND SUGAR PLANTERS.

THE LABOUR DIFFICULTY.

When, a few weeks ago, the first batch of about six hundred indentured British labourers left these shores for Queensland, the question that arose in the minds of many who know the climatic conditions of tropical Australia was, "Do they know what they are going to?" Apart from the warning issued by the Emigration Office—a notice that caused a somewhat heated discussion between Mr. Deakin and Mr. John Burns at one of the meetings of the late Imperial Conference—the situation, I am credibly assured, was fairly and clearly explained to each man, and though they were told they were going out to do black man's work in a trying climate, none were shaken in their purpose. But I fear the young, fresh-faced, sturdy, emigrants, who have gone forth to help in carrying on the work of the Empire, will have a rude awakening. No one can make another realise the meaning of manual labour, of agricultural toil, in the canebrakes of North Queensland; nothing but experience will reveal the physical discomfort and hardship of the life. Those with true grit, who can abstain from drink, may, given immunity from malaria and dysentery, win through the eighteen months for which they bind themselves, and do well. But people who know something of the life believe that more than half of them will break their engagements and go to prison rather than do the work.

A friend who, in the days of Kanaka labour, was manager on a plantation, has told me that at harvesting time, as he sat still on his horse, without raising a hand or making the least physical effort, the perspiration streamed from every pore. The workers will not be sitting on a horse out in the open, but toiling in the dense canebrakes, machete knife in hand, in a humid heat, overpowering to most Europeans; and the strongest of them cannot for some months become acclimatized and hardened to the work, even though already accustomed to agricultural labour. The experience of two harvests will be enough for the proportion of the emigrants who keep to their bond. These will doubtless become good colonists, but at the earliest opportunity they will seek their chance in the more temperate climate of the south. For the canegrowers the difficulty of getting labourers will exist in a more intensified form year by year.

The ideal of a white Australia is one that appeals to us all, is one for which all would work whole-heartedly if we felt it was attainable, and regret for the private interests that might suffer would be swallowed up in the appreciation of the public good. But the island is situated just twelve degrees too far north. Were it entirely in the temperate and sub-tropical zones, so that an effective occupation by Europeans could be established in all parts, no difference of opinion could arise over the rigid exclusion of alien coloured races. There can, however, be no question here of "cutting the painter"; Australia's tropics are an integral part of the continent, carrying with them a responsibility that cannot be shirked.

Discussing with me, when he was in London for the Conference, the possible methods of developing the Northern Territory, and the best means of utilising its rich, alluvial tracts, Mr. Atlee Hunt said they proposed to attract people by free grants of land, and that the chief industries would be pastoral and dairying.

"Will not tropical agriculture be encouraged?" I asked.

"No," he replied, "that would mean something akin to slave labour, impossible to admit among a people who hope to build up a free white nation."

"Surely there would be no objection to indentured Indians?" I persisted.

"They would refuse to return to their own country, and would settle in Australia."

"What matters if some of them do?"

"Would you have people in this free white nation who cannot be given the vote?"

"I would," I replied, "thousands of them; the work of the world is of greater value than an abstract idea."

This aspiration for a free white Australian nation, in which every adult has a voice, has led to the present acute difficulty of the sugar planters. Last year the cities of the various States were swept of their unemployed, and an idle, discontented, inefficient crew, totally without training or knowledge of agriculture in any form, were sent north to take the place of the cheap, efficient, amenable Kanakas, by whose labour an industry had been built up producing an annual crop worth two million pounds in its raw state. And to the unsuitable labourers thus provided, many of them hopeless loafers, the planter was compelled to pay an expert wage, only to see a large portion of his crop left standing at the end of the year, while the mills, irregularly supplied with cane, found the cost of crushing increased by eight to ten shillings a ton. This year, to meet the legitimate claims of the cultivators to carry out the promise made to them that suitable white labour should be available, the Queensland Government has had to go back on one of its most cherished principles, and is not only admitting indentured labourers, but has scoured Europe and the British Isles to find them. The Italian peasants, warned by the Rome Socialist paper, the "Avanti," not "to accept an occupation which is looked upon as only fit for Asiatics," refused the offers made to them; the Spaniards prefer the sugar plantations

of Hawaii; and it was only after the failure to procure these inhabitants of southern Europe, who, it was thought, would better stand the heat, that recruits were sought at home.

The wages to be paid to the men going out are 35s. a week for cutting and harvesting cane, and 32s. 6d. a week for other work, paid monthly from date of arrival, and the men undertake to serve as labourers until December 31st, 1908. The employers, who have authorised the Agent-General to complete the agreements on their behalf, have to provide proper and sufficient accommodation; and if they board the men according to a liberal ration laid out in the agreement are entitled to deduct 10s. a week from the wages. The only guarantee taken from the men is the deduction of 50s. a month from the wages of the first two months, to be held in the Queensland Government Savings Bank by the Director of Labour, who, if satisfied that the agreement is being properly carried out, will pay the amount over at the expiration of six months from the commencement of the work.

Labour at these high rates must lead to such an increase in the cost of production that Queensland sugar-growing can only be kept profitable by an addition to the already heavy duty on imported sugars. Last year's production of 204,634 tons was about 15,000 tons more than the entire consumption of Australia, yet some 42,000 tons were imported, the bulk of which came from Java, where sugar is produced so cheaply by coloured labour that, allowing for the Commonwealth duty of £6 a ton, the Australian sugar, with an excise duty of £4 a ton, of which £3 is returned as a bounty on white grown sugar, can be undersold at a profit.

Many problems have more than one solution, but it will be found that the question of agricultural labour in the tropical parts of Australia is reducible to a simple equation, with "coloured labour" as the only value of x to satisfy it. By such labour the cultivation of sugar-canes has become a most valuable asset of North Queensland; now, at the bidding of united Australia, the useful Polynesian workers have been sent to their island homes, in the vain effort to establish a white nation in a country partly tropical. When the political leaders assert that the white man can work in the tropics they think that sufficient emphasis on the *can* proves their case; but though *can* be shouted ever so loudly, *will not* must be the determining factor. A capital of five to six millions invested in the sugar lands and mills of Queensland is endangered by the action of politicians, many of whom are absolutely ignorant of the conditions obtaining in the tropics, and who are driven by a tyranny so oppressive and inimical to the welfare of the State that one trembles for the future of one's native land unless some means are devised of curbing the power of the Labour party.—(Murray Eyre in the *Pall Mall Gazette.*)

The Inhambane Sugar Estate Company near Lorenzo Marques continues to give promise of a great future. The bounty on sugar sent to Lisbon is £11 per ton. The 1907 crop is estimated at 1,000 tons.

LEEWARD ISLANDS.

Seedling Cane Experiments, 1905-06.

The seedling cane experiments in Antigua and St. Kitts, which have been a feature of the last six years, are undoubtedly serving a useful purpose, though persistently dogged by adverse conditions in the shape of unfavourable weather. But this very drawback has not been without its uses, for it has tended to bring out into prominence those canes which possess the power to cope with abnormal climatic conditions. The annual Report on these experiments as prepared by Dr. Watts (*Seedling and other Canes in the Leeward Islands, 1905-06*), has recently come to hand and from it we extract the following points of interest. The year 1905-06 was marked by the occurrence of a severe drought and this resulted in several otherwise excellent canes losing their places in order of merit, while others again took a higher position owing to their drought-resisting powers. Amongst those plant canes which have fallen out may be mentioned *B. 306*, *B. 109*, *D. 74*, and *D. 95*, while *B. 156*, *B. 208*, and *Sealy Seedling* we find near the top owing to certain ability to withstand drought. This ability is not however always accompanied by other desirable characteristics, as we find *Queensland Creole* in an unusually high position through being a hardy, drought-resisting cane, and yet Dr. Watts does not commend it for general planting. *B. 109*, *D. 95*, and *D. 130* are only worth planting in Antigua in districts where the rainfall is above the average. It may be observed that during the season under review, the rainfall on the nine experiment stations in Antigua averaged 32·53 in., the heaviest being 41·85 in. and the least 25·54 in.

As regards ratoons, it is well observed that "in estimating the value of a cane, it is important to know how it ratoons, for, under the system of cultivation in vogue, a good ratooning cane is a desideratum." The best cane of the year in this respect has proved to be *D. 109*, which came within the first seven on seven stations. *Sealy Seedling*, *B. 156*, *B. 147*, and *B. 306* come next as within the first seven on five stations. The drought has again been responsible for some deterioration in position of such canes as *B. 208*, *D. 74*, and *B. 109*.

It is to be noted that *B. 208* is well thought of in Antigua. Dr. Watts considers it "a cane remarkable for the large amount of sugar contained in its juice. . . . Opinions amongst the planters as to the ability of this cane to withstand drought vary somewhat; it is to be observed however that in some cases where upon cursory observation it was thought this cane was suffering severely, upon reaping it was found to yield an amount of sugar in excess of expectations, the extreme richness of the juice compensating for the poor appearance of the cane in the field."

Dr. Watts takes occasion to mention a fear that the root fungus (*Marasmius sacchari*) is more widely spread than planters imagine. From the fact that this fungus attacks the root tips and so prevents the cane plant from obtaining its full supply of moisture, the symptoms of the disease closely resemble the effect of drought, and hence the disease is often dismissed by the planter as merely a case of drought and this the more so that, except in bad attacks, there is not much dead cane to be seen.

Below will be found some figures extracted from the Tables in the Annual Report showing the results of the best ten canes in each class.

TABLE I.

ANTIGUA.—PLANT CANES.

Means deduced from 14 plots of each variety of Cane.

No.	Name of Cane.	CANE. Tons per acre.	JUICE. Gallons per acre.	JUICE. Gallons per ton.	SUCROSE. Pounds per gallon of Juice.	SUCROSE. Pounds per acre in Juice.
1	D. 625 ('G.')*	28·3	3,337	117·9	1·931	6,516
2	B. 156	25·7	2,888	112·4	1·919	5,544
3	D. 109	22·9	2,593	113·2	2·060	5,187
4	Sealy Seedling	22·4	2,570	114·7	2·016	5,111
5	B. 208	20·4	2,249	110·3	2·114	4,664
6	Queensland Creole†	21·1	2,291	108·6	2·036	4,580
7	B. 393	18·0	2,097	116·5	2·147	4,479
8	B. 376	20·8	2,201	105·8	2·003	4,396
9	Mont Blanc	19·4	2,147	110·7	2·046	4,233
10	Burke	19·8	2,152	108·7	2·008	4,226

TABLE II.

ANTIGUA.—RATOON CANES.

Means deduced from 16 plots of each variety of Cane.

No.	Name of Cane.	CANE. Tons per acre.	JUICE. Gallons per acre.	JUICE. Gallons per ton.	SUCROSE. Pounds per gallon of Juice.	SUCROSE. Pounds per acre in Juice.
1	D. 109‡	16·6	1,900	114·5	1·994	3,789
2	Sealy Seedling	14·8	1,698	114·7	1·947	3,307
3	B. 306§	12·4	1,445	116·5	1·990	2,876
4	D. 95	11·8	1,363	115·5	2·076	2,830
5	B. 147§	12·6	1,461	116·0	1·924	2,811
6	B. 156	13·3	1,433	107·8	1·934	2,772
7	Mont Blanc	11·4	1,257	110·5	2·186	2,748
8	B. 376	12·2	1,305	107·0	2·060	2,688
9	Burke§	11·4	1,222	107·2	2·101	2,567
10	B. 393§	11·5	1,292	112·4	1·986	2,566

* Mean of 8 plots only. † Mean of 12 plots only.
‡ Mean of 13 plots only. § Mean of 15 plots only.

Table III.

ST. KITT'S.—PLANT CANES.

Means deduced from 8 plots of each variety of Cane.

No.	Name of Cane.	Cane. Tons per acre.	Juice. Gallons per acre.	Juice. Gallons per ton.	Sucrose. Pounds per gallon of Juice.	Sucrose. Pounds per acre in Juice.
1	B. 254..	32·6	4,192	128·6	1·926	8,072
2	B 208	27·9	3,629	130·1	2·188	7,939
3	Sealy Seedling*..	33·4	4,324	129·5	1·805	7,803
4	D. 116	32·0	4,185	130·8	1·822	7,625
5	Striped Singapore	29·3	3,799	129·7	1·939	7,367
6	D. 130*	28·4	3,641	128·2	1·874	6,824
7	D. 109*	29·4	3,301	112·3	2·059	6,796
8	Mont Blanc	27·6	3,620	131·2	1·868	6,760
9	D. 74	28·6	3,744	130·9	1·787	6,689
10	Queensland Creole	26·6	3,367	126·6	1·960	6,598

Table IV.

ST. KITT'S.—RATOON CANES.

Means deduced from 6 plots of each variety of Cane.

No.	Name of Cane.	Cane. Tons per acre.	Juice. Gallons per acre.	Juice. Gallons per ton.	Sucrose. Pounds per gallon of Juice.	Sucrose. Pounds per acre in Juice.
1	Jamaica†	23·5	3,037	129·2	2·063	6,265
2	D. 95	22·8	2,977	130·6	2·091	6,224
3	D. 74	24·0	3,085	128·6	1·967	6,068
4	Rappoe†..	23·4	3,023	129·2	2·002	6,051
5	White Transparent	23·6	3,051	129·3	1·959	5,977
6	D. 116	24·8	3,264	131·6	1·818	5,923
7	B. 109..	25·8	3,343	129·6	1·766	5,903
8	B. 147	22·8	3,001	131·6	1·929	5,789
9	B. 376†	23·8	3,017	126·8	1·847	5,572
10	Queensland Creole‡..	21·9	2,724	124·4	2·032	5,536

THE FORMOSA SUGAR INDUSTRY.

Consular Report.

The British Consul at Tainan gives the following information regarding the sugar industry of Formosa:—

The total amount of raw sugar exported in 1906 was 1,283,793 cwts., valued at £848,718, against 830,620 cwts., valued at £598,668, in 1905, showing an increase in value of £250,050 as compared with 1905. The average total value for the five years 1901-1905 was £395,128.

* Mean of 7 plots. † Mean of 4 plots only. ‡ Mean of 5 plots only.

The following table shows the quantity and value of raw sugar exported to Japan, and China and Hong-Kong respectively during 1906:—

Kind of Sugar.	Japan.		China and Hong-Kong.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Cwts.	£	Cwts.	£	Cwts.	£
Brown Sugar..	1,263,940	835,330	8,569	4,022	1,272,509	839,352
White Sugar..	402	391	10,882	8,975	11,284	9,366
Total .	1,264,342	835,721	19,451	12,997	1,283,793	848,718

As compared with the figures for 1905 there is a large increase of 436,549 cwts. and £239,734 in the export to Japan in 1906. Exports to China and Hong-Kong increased also by 16,624 cwts. and £10,316.

The peculiarity of the year 1906 was the fact that old sugars could still be bought right up to September (ordinarily the crop ends in May for large lots and in June for finals), and that sugar mills continued crushing right up to August, 1906; although, after May, cane begins to lose saccharine, and crushing can only be done at a loss. This was due to two causes. Firstly, the troubles connected with the erection and running for the first time of new machinery by inexperienced mill owners, who had an inexperienced staff of engineers; and secondly, the sudden throwing on the former's hands of a large quantity of cane which was rejected for crushing by one of the most important mills on account of the fact that it was unprofitable to crush at that particular time of the year—the month of May. Consequently, as it does not pay to hold cane over, the farmers were forced to hurriedly erect old style mills to use up their cane. It seems that some compensation was paid to the farmers for not taking up their cane, but complaints were also made that the compensation given was insufficient. Fifty other new semi-modern mills, however, not having the power of a large modern factory, could not manage things in such an autocratic fashion, and were obliged to continue crushing until all their crops were reaped.

As some of the foreign firms in Anping anticipated an advance in prices when all the old sugar should have been exhausted, and made allowances for the enforcement of the new customs tariff in October, 1906, they bought sugars ahead in September for December delivery, and were able to realise fair margins. By the new tariff the import duty on Class 1 (Dutch Standard No. 8) was raised from 1 yen 52 sen (3s. 2d.) to 1 yen 65 sen (3s. 5d.), and the consumption tax was raised from 1 yen (2s. 1d.) to 2 yen (4s. 2d.); on Class 2 the import duty

was raised from 1 yen 52 sen (3s. 2d.) to 2 yen 25 sen (4s. 8d.), and the consumption tax increased from 1 yen 60 sen (3s. 4d.) to 4 yen 40 sen (9s. 2d.).

The market for the season 1906-1907 opened in November, 1906, at 7 yen 40 sen (15s. 5d.) per picul, and rose steadily to 8 yen 50 sen (17s. 8d.) by December (the highest point reached), gradually fell again to 8 yen (16s. 8d.) in January and 6 yen 80 sen in February, but rose again to 8 yen. It now stands, in March, 1907, at 7 yen 20 sen (15s.) to 7 yen 60 sen (15s. 10d.).

The season, so far as business is concerned, has been a difficult one. Hitherto most of the exporters have sold on c.i.f. terms to three or four principal Japanese importers in Yokohama, who practically control the sugar market there; and to a few other importers in Kobe, Moji and Shimonoseki. This has been a safe business, as, the sales having been made by telegram, a commission business has been worked steadily and safely; but the Japanese merchants have been studying the Formosan conditions for some years past, although without taking any very active part in operations hitherto. In the period under review, however, they commenced to take an active part in the business, buying direct at the various mills from the native Chinese and exporting themselves. Orders have consequently decreased, and commission firms have been obliged to face the alternative of either being contented with a safe business by making very small margins, or of embarking on the speculative business of buying or selling in advance. The Japanese importers at Yokohama practically control the market, and the present export and import duties, and consumption tax also, practically close the China market, which hitherto has been a wholesome check upon undue depression of the Formosan market by Japanese operators. Moreover, persons sent to study the business have discovered that the farmers and small mill owners are not rich enough to hold their stocks for long. Owing to these facts, therefore, prices have not been allowed to advance, and unless some strong association is formed to check this, the native Formosan sugar mill owners will henceforth be at the mercy of the Japanese operators, provided that the latter can work together—this, however, should not be a difficult matter, considering that they are so few in numbers. The advent of the important central factories, although it may not be of very much advantage to the farmers until they can learn to take advantage of the altered conditions, will, however, in time check the dominance of the Yokohama sugar importers.

With large sums of money released in Japan after the war, there was a slump in the money market at Tokyo, and interest was at one time considerably lower at Tokyo than in London. The usual "post bellum" boom has taken place, and people seemed to have speculated wildly in Tokyo over all shares. Sugar milling in Formosa, under

the present favourable laws, consequently attracted its full share of attention.

The shares of the Taiwan Seito Kaisha (Taiwan Raw Sugar Factory), the pioneer modern mill, established about six years ago, rose from a face value of 50 yen (£5 4s. 2d.) to 200 yen (£20 16s. 8d.), and stand to-day at 170 yen (£17 14s. 2d.). Advantage was also taken to increase the capital of the company from 1,000,000 yen (£104,166) to 5,000,000 yen (£520,833). This company has one factory at Kyoshito of 600 tons (American short tons of 2,000 lbs.) capacity in 24 hours. The machinery was supplied by a Glasgow firm. It is intended to erect a new 2,000-ton (tons of 2,000 lbs.) mill at Ako. Another mill for this company of 800 tons capacity (short tons) is also to be erected at Kohekiryo, near Takow, and the machinery is also to be supplied by the Honolulu Ironworks. The 2,000-ton mill has been purchased second-hand at Honolulu and will be erected, after having been renovated with improved machinery, by the Honolulu Ironworks. The Nippon Seito Kaisha (Japan Raw Sugar Factory), which is one of the refineries in Osaka, has also taken advantage of the boom to augment its capital for the purpose of establishing a new 1,200-ton (American tons of 2,000 lbs.) factory in Formosa for the manufacture of raw sugar for its refineries. The district allotted for this company is at Tarimu in Toroku Cho. The plant is being supplied by a German firm.

It is impossible to foretell the future with any certainty, as business conditions in Formosa under the present active Government change so rapidly, but there is no doubt that the outlook for the few foreign sugar firms now remaining is a gloomy one unless they take up a sugar mill, which involves the investment of a large capital, or unless some new trade springs up. Practically speaking, most of the available land at present planted with cane is allotted to the various mills, and the majority of small mills, semi-foreign included, will be absorbed by the big factories which produce a different kind of sugar. As these big factories have such large capital it is most probable that they will either sell their sugars direct to Japan or consign to Japanese firms in Japan. The foreign firms will, therefore, probably have no reasons for continuing business, not even as commission forwarding agents. The majority of the new mills will be erected by the end of 1908, in time to take off the 1908-09 crop, and are all sure to be established by the end of 1909.

The following are the impressions of the representative (Mr. W. M. Sandison) of a British firm of sugar machinery engineers who is now visiting the island, which may possibly be of some interest:—"My impressions regarding the largest raw sugar factories now working in Formosa, which are much smaller in size than the average sugar factories in Cuba, Java, and Hawaii, are as follows:—Too much money has been expended on elaborate buildings (brick and woodwork),

too little on machinery or on means for bringing the cane rapidly to the factory and feeding the mills rapidly. The cane contains a large percentage of fibre, 14 per cent. on the average, which ensures steam raising on an economical basis if good megass furnaces are introduced. The mills as a rule seem to have given dissatisfaction by not quite coming up to their rated capacities, which is attributable to the hard quality of the cane. It would seem that with such a large percentage of fibre a better extraction of the sucrose would be attained by the adoption of the 'maceration' process so much in vogue in modern sugar factories; one, if not more, of the larger schemes now under consideration will carry out this practice on the 'sprinkling' but not on the 'bath' method, although the tendency would seem to be towards the adoption of so-called eleven-roller mills, viz., really three-roller mills on one bed plate plus a two-roller preliminary breaker or crusher without macerator. None of the mills, so far, have been fitted with this preliminary crushing arrangement, though certain of the existing mills are five-roller, in which two of the rolls to a certain extent effect preliminary breaking up of the cane, but not to the same extent as the specially fluted rolls now so much employed in Cuba and elsewhere. The foregoing Formosan mills carry out double or triple crushing, more or less efficiently; preliminary crushing and maceration would probably bring them on an equally efficient basis with the better class mills in other parts of the world. Some modern green megass furnaces are in operation with forced draught, and the steam boilers employed are of various types—double, tubular, elephant—but the water tube type will make its advent next season; vertical double and triple effect evaporators are in use, also vacuum pans, usually of the ordinary coil class, but also of the calandria or straight tube type. One or more of the coming new factories will be equipped with pressure clarification apparatus, and that of the Toyo company will have automatic time weighing appliances and fixed filtration of the juice through cloud sand filters after subsidation. The centrifugal sugar curing machines in most cases are of the belt-driven type, but the water-driven type are also used, whilst electrically-driven machines have not hitherto been adopted here. Drying of the sugar after centrifugalling is usually carried out."

The Mirrlees Watson Company Ltd., of Glasgow, have lately secured the contract for a sugar factory in Formosa to handle 1000 long tons of cane in 22 hours. The plant is a most modern one, and contains several interesting features. Owing to the risk of earthquakes the buildings and staging (steel throughout) are designed to give great stability, and at the same time admit of a roomy and well lighted arrangement of the machinery. The canes will be brought

by rail, tram, and buffalo cart to the mills, unloaded on to the carrier by a mechanical cane unloader, and passed through a multiple mill consisting of a 30 in. × 84 in. Mirrlees-Krajewski crusher and three 34 in. × 84 in. three-roller mills driven by a 34 in. × 60 in. piston valve engine, with all bearings constructed of the Mirrlees special mixture of gun metal. Maceration water is applied to the megass upon the carriers between the mills. The megass from the last mill is elevated, conveyed, and delivered to four Babcock and Wilcox type watertube boilers, each of 5150 square feet heating surface. Special furnaces for burning the green megass are fitted to each boiler, and forced draught will be used to accelerate combustion, and a fireproof megass firing stage provided to minimize fire risks.

The juice, leaving the mills, passes through a continuous strainer. It is then automatically weighed and discharged to liming tanks, where the correct quantity of lime is mixed with the juice, the whole being mechanically agitated. The juice leaving the liming tanks is then pumped through high pressure heaters, and delivered to eight large subsiding tanks of special construction (being almost entirely closed so as to assist subsidence by eliminating local currents). The clear juice from the subsiders is decanted and forced through four closed sand filters to the quadruple effet supply tanks.

These sand filters are fitted with power-driven washing arrangement so that the sand may be washed in a few minutes without removing it from the filters, thus eliminating the loss of sand and reducing the loss of sweets to a minimum.

A quadruple effet containing 14,000 square feet heating surface is provided, with the usual pumps, barometric condenser, and high efficiency dry air pump of the Mirrlees Watson Co.'s well-known design. Underneath the quadruple effet, soda tanks are fixed to economize the soda used when washing out the evaporating apparatus. Three 12 feet vacuum pans, two of the coil type, and one of a special calandria type, are provided to deal with the syrups, being fitted with a barometric condenser and high efficiency dry air pump.

The masse-cuite from the vacuum pans is struck out into 12 crystallizers each of 6,000 gallons capacity, with all the usual fittings. After treatment in the crystallizers it is run to twelve 40 in. water-driven centrifugals arranged to cure first and second sugars. The dry sugar from the centrifugals is elevated, and conveyed to two revolving dryers, so as to finish the sugar in the best possible form for transportation.

It may be added that shipment is to be made before the end of this year, and the plant is to be completely erected and ready for work to take off the crop which commences in December of next year.

Austria-Hungary.

Imports of British sugar into Austria-Hungary during 1905 and 1906:—

1905. Metric.	1906. Tons.	1905. £	1906. £
166	56	1,121	343

Exports of sugar from Austria-Hungary to British territory during the years 1905 and 1906:—

Destination.	1905. Met. Tons.	1906. Met. Tons.	1905. £	1906. £
United Kingdom	237,380	323,036	2,480,045	3,516,028
British India	103,306	141,839	1,202,281	1,551,871
Canada	49	660	513	5,646
British Mediterranean Possessions	2,905	6,392	34,526	70,128

Turkey.

Diarbekir.—An increased quantity of sugar is consumed yearly in this Consular District. Austria-Hungary supplies three-quarters of the imports, and the United Kingdom one-quarter. The superiority of British sugar is generally recognized, but it cannot compete in price with the Austro-Hungarian product. In 1906 the value of imports was £20,000.

Erzeroum.—In this district French sugar is chiefly consumed. Out of £34,000 worth imported in 1906, France's share was £25,000; the rest came from Austria-Hungary.

China.

Amoy.—Sugar used to be exported in large quantities, but the trade has been deeply cut into by sugar from Java and Manila, despite the fact that prices fell from 17 dol. 18 c. per picul in 1905 to 12 dol. 13 c. per picul in the year under review. The export has fallen from 278,761 cwts. in 1896 to 79,252 cwts. in 1906.

Canton.—White sugar is imported from Java, where it is chemically prepared. It has found great favour in these parts, and has considerably reduced the import of the refined Javan sugar of the T'ai Ku and China sugar refineries in Hong-Kong.

	Average, Previous Five Years, 1900-04.	1905.	1906.	Increase or Decrease compared with 1905.
Imports:—				
White	110,632	153,062	316,795	+ 163,733
Brown	7,658	1,787	15,970	+ 14,183
Exports:—				
Brown	133,583	122,169	63,052	— 59,117
White	2,274	1,229	1,564	+ 335

Chungking.—Tzuchou and Neichiang are the chief producers of sugar. About 15,000,000 catties (20,000,000 lbs.) of white sugar, valued at 500,000 strings of cash (£50,000), were sent from Tzuchou in 1905, two-thirds going up-river from Tzuchou, and one-third down to Wan Hsien. All the brown sugar from that district goes down-river, one-quarter to the Chialing River district and three-quarters to Hupeh.

Foochow.—Imports of sugar during 1906 were as follows:—

	Quantity. Cwts.	Value. £
Brown	25,862	13,765
White	78,332	51,889
Refined	20,045	14,272
Candy	34,469	31,698
Total, 1906	158,708	111,624
,, 1905	135,002	103,874
Increase in 1906	23,706	7,750

Wuchow.—The trade in sugar, which comes from the Hong-Kong refineries, shows a very large increase in 1906. In 1905 the quantity imported was 11,164 cwts.; in 1906 it was 28,893 cwts.

On the other hand, the export of native sugar from Wuchow has practically died out, only 67 cwts. having been exported in 1906 as against 7,336 cwts. in 1905.

When one considers that in 1900 the import was 300 cwts. and the export over 160,000 cwts., it is remarkable how rapidly rebellion, internal disorder, and bad harvests have succeeded in killing what was a prosperous industry in the province of Kwangsi.

Japan.

There was a great increase in the import of sugar during 1906, the decrease between 1904 and 1905 being more than recovered. A glance at the figures, however, will show that the character of the import has changed considerably. The development of the Japanese sugar refineries is creating a demand for raw sugar which cannot at present be satisfied by supplies from within the Empire. There is, therefore, a large market for foreign raw sugar, but that this may mean the partial loss of a market elsewhere will be seen by reference to the export tables which show the remarkable expansion of the Japanese sugar export trade. The current prices throughout the year ranged as follows:—

	Price per cwt. From £ s. d.	Price per cwt. To £ s. d.
Brown Takao	0 11 11	0 16 5
,, Manila (Nos. 12 and 13)	0 13 6	0 16 11
,, China	0 12 3	1 2 6
White Java and Penang	0 14 8	1 3 6
,, refined	1 3 2	1 8 7

In many cases sugar is a luxury, and the decline in the import of refined sugar in 1905 was a sign of the strain of the war; in 1906 much of the ground lost by refined sugar was regained, but in view of the very rapid development of the native sugar refining industry it is more than doubtful whether the improvement will be maintained in future years.

Imports into Japan during 1905 and 1906:—

	1906.		1905.		Average, 5 years, 1901-05.
Sugar—	Tons.	£	Tons.	£	£
A and B	204,273	2,147,947	124,241	1,331,858	1,371,100*
,, refined ..	21,091	274,079	4,835	67,316	786,460†
Molasses	62	339	97	479	1,543
Total	..	2,422,365	..	1,399,653	2,159,103

Exports.

Sugar, refined	50,208	1,121,304	14,726	394,145 ‡	..

Of the imports in 1906, those from Hong-Kong were as follows:—

	Tons.		£
Raw	1,605	..	10,893
Refined	1,157	..	19,111

Yokohama.—The value of refined sugar imported during 1906 amounted to £127,842, being £79,842 above the previous year, but small in comparison with the quinquennial average of £355,135. The importation of refined sugar is, in fact, a moribund trade. It has now become instead a considerable article of export. Some day, if the present efforts to extend the area under sugar cultivation in the southern parts of the Empire are successful, we may see the import of raw sugar follow the now approaching fate of refined, and Japanese refineries supply their needs entirely with the native product. For the moment, however, so great is the expansion of the refineries, which the Government encourages by the rebate law, that the import of raw sugar is much stimulated, with the result that the figures rose to £869,735 in 1906 from £502,890 in the previous year. The year opened with prices for brown Takao 8 yen 20 sen to 8 yen 80 sen per picul (£14 0s. 10d. to £15 1s. 10d. per ton); white Java and Penang, 12 yen 60 sen to 13 yen 60 sen per picul (£21 12s. 2d. to £23 6s. 6d. per ton), and white refined 14 yen 70 sen to 17 yen per picul (£25 3s. 2d. to £29 3s. 1d. per ton), closing with

* Nearly all Dutch Indies, 6 per cent. up to No. 7 Dutch colour standard.

† Nearly 70 per cent. German, practically all over No. 20 Dutch colour standard.

‡ 90 per cent. to China, nearly 10 per cent. to Corea.

9 yen 50 sen (£16 5s. 10d. per ton) for the first, 8 yen 50 sen to 12 yen (£14 11s. 7d. to £20 11s. 7d. per ton) for the second, and 13 yen 40 sen to 16 yen 30 sen (£22 19s. 7d. to £27 19s. 1d. per ton) for the third-named).

Martinique.

The British Consul reports:—The high prices ruling after the ratification of the Brussels Sugar Convention led to the area under cane cultivation being increased, and the crop of 23,938 tons in 1904 rose successively to 30,186 tons in 1905 and to 42,241 tons in 1906. Whereas, however, for an increase of 6,248 tons in 1905 over 1904 the increase in value was £183,317, the value of the exports of sugar in 1906 as compared with that of the exports of 1905 shows a decrease of £29,534, notwithstanding that the output was greater by 12,055 tons. The highest prices realized during the year 1906 did not exceed £12 per metric ton, whilst those of the previous crop reached at one moment £18.

Exports of rum increased from 2,014,338 gallons, valued at £136,647, in 1905, to 2,496,069 gallons, valued at £194,288, in 1906.

PUBLICATIONS RECEIVED.

Liste Générale des Fabriques de Sucre, Raffineries et Distilleries de France, &c. 39th year of publication, 1907-08. Bureau du Journal des Fabricants de Sucre, 160, Boulevarde de Magenta, Paris.

This "hardy annual" has just been issued for the 39th time. Besides France, Germany, Austria-Hungary, Russia, Belgium, Holland and Great Britain and several Colonies all find space in its pages. Lists of United States refineries and beet sucreries are also given, and the usual information as to rules, regulations and laws relating to sugar in various countries will be found set forth. But we must complain at the lack of a good index; the compilers might very well add this necessary adjunct to their next volume, and place it where it can be readily found. At present one has to wade through some 300 pages to ascertain what the volume contains, and the text is almost buried in a mass of advertisements.

Bulletin de l'Association des Chimistes: Table des Matieres des 20 premiers Volumes (1882-1902) por Léon Pollet. 8d.

Mr. Léon Pollet has here compiled an index of the subject matter and the authors contained in the first 20 volumes of the *Bulletin*. This should prove of value to those chemists who desire to inform themselves where and when certain articles have appeared. The price of the Index is very low, and it can be procured from 156, Boulevarde Magenta, Paris.

Zabel's Jahr und Adressbuch der Zuckerfabriken Europa's; Verlagsanstalt für Zuckerindustrie, Magdeburg, Germany. Mks. 4.

This German directory of European sugar factories is well got up, and in it the reader will find a detailed account of any given factory, there being eleven columns filled in with particulars, including one of factory procedure. The convenient method of using printed signs to represent certain facilities in use has been introduced to an extent that we never noticed before. Such include telephones, water accommodation, railway connections, electric lighting, electric power, &c.; and as a variation from printed words, they greatly facilitate investigation.

Past and Present with an Old Firm.

This is a booklet issued by Messrs. Joseph Travers & Sons, Ltd., the well-known wholesale grocery firm, giving a short history of their career in the trade. The original Joseph Travers was born in 1752, and since his inauguration of the firm that bears his name, a steady and prosperous increase in its business has been recorded, leading up to the publication of a weekly trade paper, the *Produce Markets Review*, which possesses a very good circulation. The booklet is well illustrated and will pay a perusal.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Application.

18549. P. Bévenot, London. *Improvements in apparatus for the extraction and dessication of the solid parts contained in natural fluids or in solutions and particularly for the production of milk powder and the extraction of sugar from saccharine juices.* (Date applied for under Patents Act, 1901, 20th August, 1906, being date of application in Belgium.) (Complete specification.) 16th August, 1907.

Abridgment.

25340. J. J. Eastick, London. *Process for making and purifying invert sugar.* 10th November, 1906. This invention relates to a process for the manufacture of invert or partially inverted sugar by which the bases of the salts are precipitated by hydrofluosilicic acid, and the liberated acids are utilized to invert the sugar.

GERMAN.—Abridgments.

185985. Theodor Halpaus, of Rittmarshausen, near Göttingen. *A boiling down apparatus having a perforated circulation pipe.* 20th June, 1906. In this arrangement the upper part of the circulation pipe, which projects in known manner above the highest level of the

substances to be boiled and stands above the heating body, is formed as a fine meshed sieve, with the object of operating a circulation of the mother liquor alone but not the crystals through the pipe, the heating body and the crystals. A further arrangement comprises a worm arranged inside the circulation pipe, which scrapes from off the inner side of the sieve, the mother liquor, which penetrates through the sieve holes.

186074. ASKAN MÜLLER, of Hohenau, Lower Austria. *An evaporating and boiling apparatus more particularly for the sugar industry.* 13th April, 1906. In this apparatus there is a vane wheel arranged beneath the wide pipe for the descending liquid, which wheel operates a circulation of the liquid, and the apparatus is further characterized by the conical and annular plate of the vane wheel being provided with an aperture in the bottom, with the object of producing a thorough mixture of the fresh liquid introduced with the already circulating liquid from the upper part of the apparatus which sinks downwards through the said aperture. Another feature consists in the fresh liquid introduced into the apparatus being conveyed tangentially into a hollow annular body from which it passes through apertures into the lower part of the apparatus and encounters a rebounding plate by means of which it is conveyed along the inclined floor to the walls of the apparatus. A further feature consists in the lower ends of the pipes which pass through the heater, through which the upwardly rising liquid flows being cut off obliquely and arranged in the heating body in such a way that the shorter casing surfaces of the pipes are turned towards the direction of movement of the liquid, with the object of facilitating the rising of the liquid in the pipes.

186201. FRIEDRICH RITTER VON KLAUDY, of Regensburg, and FRANZ JUNGER, of Prague. *A diffuser with a mechanical discharging arrangement.* October 28th, 1906. This diffuser is characterized by a revolvable sieve bottom and if desired a fixed scraper arranged radially above it.

NOTE.—Copies of all published specifications with their drawings in these lists can be obtained from W. P. Thompson & Co., 6, Lord Street, Liverpool, at One Shilling a copy for English or American Patents, and Two Shillings for German. In ordering please give number and date.

Patentees of Inventions connected with the production, manufacture and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of August, 1906 and 1907.

IMPORTS.

Raw Sugars.	Quantities. 1906. Cwts.	Quantities. 1907. Cwts.	Values. 1906. £	Values. 1907. £
Germany	6,268,016	5,233,864	2,669,717	2,472,246
Holland	50,528	301,872	19,031	152,620
Belgium	518,123	234,214	217,064	104,906
France	203,252	329,336	87,073	167,042
Austria-Hungary	163,050	281,555	66,335	126,993
Java	223,400	184,601	104,766	95,721
Philippine Islands	....	187,721	....	77,287
Cuba	111,885	91,113	41,943	39,610
Peru	443,238	430,973	199,361	214,364
Brazil	957,933	189,919	375,649	78,330
Argentine Republic	....	....	....	....
Mauritius	126,741	452,244	48,362	184,681
British East Indies	88,267	118,274	34,351	50,509
Straits Settlements	55,928	129,412	22,959	53,657
Br. W. Indies, Guiana, &c.	1,435,365	1,093,564	761,379	627,677
Other Countries	182,863	490,571	84,849	243,209
Total Raw Sugars	10,828,589	9,749,233	4,732,839	4,688,942
Refined Sugars.				
Germany	8,572,172	9,259,813	4,870,192	5,464,211
Holland	1,910,140	1,757,087	1,146,019	1,113,361
Belgium	254,699	226,712	148,007	137,741
France	1,701,623	2,500,909	950,964	1,457,890
Other Countries	751	2,635	454	1,830
Total Refined Sugars	12,439,385	13,747,156	7,115,636	8,175,033
Molasses	1,802,576	1,841,770	347,137	363,690
Total Imports	25,070,550	25,338,159	12,195,612	13,227,665

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	127	292	114	220
Norway	12,545	9,636	7,417	5,844
Denmark	73,640	69,080	37,061	37,439
Holland	51,545	44,837	31,042	30,109
Belgium	7,072	6,331	4,088	3,877
Portugal, Azores, &c.	19,037	13,870	10,365	7,761
Italy	26,002	16,256	13,215	8,710
Other Countries	439,593	332,124	283,948	246,774
	629,561	492,426	387,250	340,734
Foreign & Colonial Sugars				
Refined and Candy	28,298	24,511	17,429	16,150
Unrefined	148,633	58,921	75,727	35,146
Molasses	5,476	4,048	1,749	1,172
Total Exports	811,968	579,906	482,155	393,202

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to September 19th	1,536,137	..	1,498,641
Receipts of Refined ,, ,, ...	670	..	1,555
Deliveries ,, ,, ...	1,517,960	..	1,540,038
Consumption (4 Ports, Exports deducted) since January 1st..	1,415,840	..	1,458,125
Importers' Stocks, September 18th. ..	18,177	..	17,136
Total Stocks, September 25th	235,000	..	211,620
Stocks in Cuba, ,, ...	68,000	..	38,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1906 AND 1907.

(Tons of 2,240lbs.)	1906. Tons.		1907. Tons.
Exports	1,074,404	..	1,281,791
Stocks	69,836	..	93,941
	1,144,240	..	1,375,732
Local Consumption (eight months)	29,550	..	30,430
	1,173,790	..	1,406,162
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 31st August	1,154,340	..	1,406,162

Havana, August 31st, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR EIGHT MONTHS ENDING AUGUST 31ST, 1907.

SUGAR.	Imports. 1905. Tons.	1906. Tons.	1907. Tons.	Exports (Foreign). 1905. Tons.	1906. Tons.	1907. Tons.
Refined	471,281	621,969	687,358	724	1,415	1,226
Raw	445,904	541,429	487,461	2,687	7,432	2,946
Molasses	79,233	90,129	92,088	135	274	202
Total.........	996,418	1,253,527	1,266,907	3,546	9,121	4,374

	Home Consumption. 1905. Tons.		1906. Tons.		1907. Tons.
Refined..	472,564	..	598,121	..	663,748
Refined (in Bond) in the United Kingdom	350,256	..	371,484	..	335,454
Raw	69,207	..	82,756	..	82,147
Molasses	74,609	..	84,783	..	87,596
Molasses, manufactured (in Bond) in U.K.	34,734	..	39,213	..	41,523
Total	1,001,370	..	1,176,357	..	1,210,468
Less Exports of British Refined.....................	16,668	..	31,478	..	24,621
Total Home Consumption of Sugar	984,702	..	1,144,879	..	1,185,847

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, SEPT. 1ST TO 21ST, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1907.
145	215	326	161	51	898

	1906.	1905.	1904.	1903.
Totals	1088 ..	773 ..	1103 ..	1488

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING AUG. 31ST, IN THOUSANDS OF TONS.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1857	1172	650	540	199	4418	4440	3731

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.	1903-1904. Tons.
Germany	2,238,000 ..	2,415,136 ..	1,598,164 ..	1,927,681
Austria	1,344,000 ..	1,509,870 ..	889,373 ..	1,167,959
France	756,000 ..	1,089,684 ..	622,422 ..	804,308
Russia	1,470,000 ..	968,000 ..	953,626 ..	1,206,907
Belgium	283,000 ..	328,770 ..	176,466 ..	209,811
Holland	181,000 ..	207,189 ..	136,551 ..	123,551
Other Countries .	445,000 ..	415,000 ..	332,098 ..	441,116
	6,717,000	6,933,649	4,708,758	5,881,333

THE INTERNATIONAL SUGAR JOURNAL.

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☞ All communications to be addressed to the Editor, Office of "The Sugar Cane," Altrincham, near Manchester.

All Advertisements to be sent direct.

Cheques and Postal Orders to be made payable to NORMAN RODGER, Altrincham.

The Editor will be glad to consider any MSS. sent to him for insertion in this Journal and will endeavour to return the same if unsuitable; but he cannot undertake to be responsible for them unless a stamped addressed envelope is included.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTICE TO READERS.—If the Advertisement pages stick together, bang their edges on the table, when they should easily separate.

NOTES AND COMMENTS.

Regular Labour on Plantations.

It is a common difficulty experienced by plantation owners in the tropics that the coloured labourers they employ often cannot be induced to work steadily, as a consequence of which it is impossible to keep the factory regularly supplied with canes. It is therefore worth while placing on record any attempts which may be made to overcome this drawback. On one plantation in Demerara the following experiment is being tried. A contract system has been introduced whereby black cane cutters and other labourers can obtain a steady and remunerative rate of wages by signing a contract binding themselves to work not less than five days a week. In return for this, each labourer will be entitled to a bonus at the rate of 10% on the wages he has earned during a stipulated period and at the end of the crop season he will be presented with free grants of sugar and firewood. In addition he will receive free medical attendance during the period of the contract. It is to be hoped that under these inducements, the men who formerly would only work two or three days a week will now put in a regular appearance and allow the work of the factory to go on without any interruption.

Advertising Sugar.

It is pointed out in a contemporary that sugar is the one large commodity of universal consumption that is not advertised extensively in the popular press under given names and brands. Whereas we have coffee, salt, mustard, tea, and confectionery advertisements attracting our attention in almost every paper we take up, very little attempt has so far been made to familiarize the public with special brands of sugars, and in consequence they are left entirely at the mercy of their grocers. It is quite conceivable that the "best granulated" bought at one shop may be very different from the "best granulated" offered at another, but in the absence of further details as to origin one is left quite in the dark regarding the precise quality. One or two Greenock firms have made a speciality of putting their sugars in bags with their name thereon, and we believe with considerable success; but in England if we except the well-known branded packing cases in which the sugar leaves the refinery, and which are frequently afterwards used as receptacles for anything under the sun, no name is set before the public to any marked extent to be associated with certain high-class brands of sugar. We believe that Messrs. Tate & Sons have now begun to pack their sugars in 28 lb. boxes suitably labelled; but we think that the retailing of sugars in bags of 7 lbs. and upwards might very well be extended. And if such sugars were well advertised under distinctive names, the public would soon learn to distinguish the brands most suited in quality and price to their particular requirements, and would order their selection regularly. At present however they are mostly dependent on their grocer's selection of what is best. The fact that the price would fluctuate would not necessarily prove a obstacle to this plan. At the present time there are several instances of sugars being sold in this manner. Thus the West Indian Produce Association has for some time past sold many of its sugars under distinctive names and put up in various weights, and we believe that this departure from the common practice has been to their benefit.

Sugar in Argentina.

There is no small discontent evinced in Argentina, if we are to believe reports to hand, at the prohibitive duties levied in that country on foreign sugar for the purpose of bolstering up the native sugar industry. The people want cheap sugar but though the law of Congress has given the Executive the power of reducing the price of sugar by suspending the duties on foreign sugar, yet this power is not exercised because the importation of foreign sugar would be prejudicial to the home sugar manufacturers who carry on their business by means of borrowed capital at high rates of interest.

The last crop produced only 116,000 tons of sugar while the annual consumption is about 140,000 tons. Foreign raw sugar was imported

to make up the deficiency and the refiners put up the price of the home-grown article to the level of the imported sugar on which a duty had been paid. As a consequence the consumer had to pay about 60 cents. per kilogram, equivalent to 1 franc 32 centimes—a price for sugar only exceeded in Italy. This principle of "robbing Peter to pay Paul" is apparently to be continued till sugar is produced in such abundance as to reduce the price all round. The critics of this measure aver, however, that the consumer will have to wait 20 years for such a consummation.

This state of affairs fully justifies the Brussels Commission in penalizing Argentine sugar. At the same time it is clear that the latter will not for a long time figure on the European markets to any appreciable extent, as the sugar manufacturers out there are hardly likely to jeopardize the comfortable position they hold by sending abroad sugars which are urgently needed at home.

Estimation of Water in Syrups, &c.

In connection with the article on this subject in our October number by Mr. Main we would point out that the Butter Refractometer (which is probably in the hands of many more chemists than the Abbe Refractometer), can be used directly for the estimation of water in those syrups containing from 19% to 51% of water, and of course by the method of dilution, for samples containing less than 19% of water. As there is no means of correcting the dispersion, the fringe of colour makes it less easy to read than the Abbe instrument, but very satisfactory results can be obtained with it.

A Charcoal Revivifying Plant for South Africa.

Messrs. McArthur & Orkney, Consulting Engineers, Greenock, have placed an order for a complete Charcoal Revivifying Plant with Messrs. Blake, Barclay & Co., of that town, which plant will shortly be shipped to a large sugar refinery in South Africa. The revivifying kilns will be of the makers' well-known design, and the feeding and discharge of the material will be entirely automatic. Special charcoal driers will be installed, which will be heated by the waste products of combustion coming from the revivifying kilns. The installation will be complete with elevators, conveyers, and all the structural work necessary.

The Cartsburn Refinery, Greenock.

We learn that the plant and machinery in the Cartsburn Sugar Refinery, Greenock, has recently been sold to Messrs. P. & W. Maclellan, Ltd., Glasgow, through Messrs. McArthur & Orkney, of Greenock.

GERMANY, RUSSIA, AND THE NEW SUGAR CONVENTION.

In our article on "The New Sugar Convention" last month we concluded with the following words:—

"All this shows that there would have been good hope, or at all events good means for securing, that Russia could join the Convention on terms reasonably acceptable by both parties. But now that bounty-fed sugar is to be admitted into the United Kingdom on equal terms with other sugar this hope vanishes. Russia will enjoy an exceptional position without any further trouble or anxiety, and the only remaining point of interest is the attitude of the great producing industries of France, Germany and Austria, and what will happen if their Governments or Parliaments refuse to ratify the new Convention."

We give this quotation because it comes in very opportunely in dealing with the important announcement which appeared after our article had been published. Germany, it is stated, will not ratify the new Convention unless Russia becomes a contracting Party. Here is what we foresaw, and we now have to examine a more definite situation. What we said last month we say again now; Russia has no longer any inducement to join the Convention. Our diplomatists can find no means of persuading her. Our Government, by their short sighted and misguided action, have taken away the mainspring of the machine, it will no longer work; so Russia will smile, sit still and do nothing. M. Dureau, in the *Journal des Fabricants de Sucre,* most truly pointed out some weeks ago that the re-opening of British markets to bounty-fed sugar puts an end to the opportunity of inducing Russia, or any other bounty-giving State, to join the Convention and abolish its bounty. This, as we said at the time, is a real and vital objection to the new sugar Convention and is quite sufficient in itself to condemn it. Probably it will turn out to be also quite sufficient to destroy it. Our Government have in fact declared to the world that they desire—for some unknown reason—to preserve and prolong the Sugar Convention, but that it must be in an improved form; the contracting Parties are to continue in their present position, tied down to their engagement of 1903; but Russia and all other States who please to do so are to be allowed, after 1st September, 1908, to protect their sugar producers not only in their own markets but also in ours, to their heart's content. The Government have declared themselves to be the bulwarks of Free Trade, and this is their first opportunity of giving practical proof of the truth of their assertion, and a practical illustration of the kind of thing which they are pleased to call "Free Trade." The old Convention abolished the

protection of foreign producers in British markets so far as sugar is concerned. The new British Government propose to substitute a new Convention which deliberately restores that worst form of protection, and they do so because they claim to be "the bulwarks of Free Trade."

France has now followed the lead of Germany. The Syndicate of French Sugar Manufacturers met on the 18th of October and, after a long discussion, unanimously resolved as follows:—

"The Chamber of the Syndicate, considering that the renewal of the Brussels Convention would further aggravate the already very precarious situation of the French sugar industry, is of opinion that the ratification of the *Acte additionnel* should be subject to the adhesion to the Brussels Convention of all the European nations producing sugar, and to the reduction of the consumption duty in France to the rate which shall be adopted in Germany."

We now have two out of three great sugar producing States who are parties to the Convention in direct opposition to the New Convention, except on conditions which appear, under existing circumstances, to be impossible. Russia and other sugar producing States have been deprived, by the British Government, of any inducement to join the new Convention. All they need do is to sit still and wait quietly till the 1st September next, when their sugar will find free entry into British markets. No diplomatic skill can induce them to do otherwise.

On the other hand our negotiators might concentrate their efforts on France and Germany, and point out that they are really fighting a shadow. As we showed last month the fear of Russian competition has very little solid foundation. The surplus of Russian sugar next September, owing to two good crops, will not amount to anything very serious. The excess, after allowing about 130,000 tons for the normal exports to Finland, Persia, and Turkey, will not, according to M. Sachs' calculations, amount to more than about 350,000 tons, taking this year's crop at its maximum estimate. According to a more recent estimate the surplus would not exceed 240,000 tons. If this sugar were thrown suddenly on the world's market it would undoubtedly depress prices for a time. But the Russians have of late years shown great caution and judgment with regard to their surplus stocks, and it is probable that they will continue to do so. A large portion of the surplus will probably be carried over to the contingent for the next campaign, in which case we shall see a large decrease in sowings for 1908-9. In any case the fact remains, as we have previously explained, that Russia cannot produce cheap enough to compete in European markets, and cannot convey its sugar such long distances except at a cost which renders competition impossible. Even at factories most conveniently situated for exportation the cost of transport to London

is, according to M. Sachs, from 5 fr. to fr. 6·50 per 100 k., as compared with an average of about fr. 1·60 per 100 k. for German factories.

Our negotiators must also impress upon Germany and France that the incentive to over production in Russia has been greatly reduced by the modifications introduced in the Law of 1903. This fact, coupled with the considerations stated above, ought to be sufficient to show how little foundation there is for fearing any appreciable competition from Russia in European markets.

To all this our neighbours in France and Germany may turn a deaf ear. They have carefully considered the situation and have now definitely stated the conclusion to which they have come. They may reply that the time for argument has expired and that Great Britain must now take her own course, either adhere to the original terms of the Convention or denounce it. Their view is well expressed by M. Dureau in the *Journal des Fabricants de Sucre* of the 23rd October, in the following words:—

"But it must be admitted that the attitude of England makes it now impossible or very difficult to attract new adherents to the Brussels Convention. It is under the permanent menace of bounty-fed competition, Russian or otherwise, on the markets of England, that the industry of the Contracting States must in future be carried on. Is this a condition favourable to the normal development of the production and exportation of those continental countries which have renounced bounties?"

We answer at once without hesitation that it is not. The "free trade" of our Government is not free trade but its exact reverse. For thirty years we have endeavoured to make this clear. Perhaps the fate of the new Sugar Convention next February will make it sufficiently manifest to the meanest capacity; and then we hope the truth will at last prevail.

The labour situation in the Hawaiian Islands has been more satisfactory this year. The United States of America's exclusive law against Japanese going to the mainland has done a great deal of good, and as the agitation of the white labour in Vancouver has also put a stop to Japanese going to British Columbia from Hawaii, the Hawaiian planters have not suffered from any shortage of labourers.

SOME ASPECTS OF THE RUSSIAN SUGAR INDUSTRY.

(From the *Deutsche Zuckerindustrie*).

The Russian sugar industry is just as old an affair as the German. The same year that Achard began to put Marggraf's discovery to a practical test in Germany, the first Russian sugar factory was started; this was in 1802 at Aljalijew in the Province of Tula. The founder of this factory was a landowner named Blangenhagen and his scheme was financed by the Government to the extent of 5,000 roubles. A second factory followed in 1809. But it was not till 1825 that the development of the industry became appreciable.

During the past ten years, 1896-1906, the area under beet cultivation has risen from 320,000 to 488,000 dessatines (1 dessatine = 2·7 acres), and midway between these years was as much as 428,000 dessatines. It is therefore evident that as regards area under cultivation, Russia is at present an easy first amongst the beet-growing countries of the world.

The beet-growing area was at first confined to the provinces of Moscow, Kalish, Grodno, Smolensk, Nijni-Novgorod, and several others. But to-day, it is the exception to find beets growing in the black soils of the northern provinces. Their cultivation is now concentrated in the south-western provinces of Kieff, Volhynia, Podolia, Bessarabia, and Kherson, the central black-soil provinces of Koursk, Poltava, Kharkov, Tchernigov, Veronej, Orel, Samara, Tambov, and Tula, as well as Poland with the exception of Juval. The south-western provinces are the most important for the sugar industry. In this district are situated nearly half Russia's sugar factories and the area under beets is more than 50% of the total beet area of the empire. The much more extensive black-soiled central provinces take second place whereas the third is confined to the Vistula territory.

The area under beet cultivation has increased year by year, nevertheless the increase has not been proportional. As a matter of fact the figures for the decade ending 1894—that is, till the coming into force of the Law of November, 1895—show an extremely slow increase. From 1885 to 1894 the area increased from 299,000 to 307,000 dessatines or only 2·7%. The number of factories in operation even decreased from from 241 to 227. In the subsequent decade, when the Law in question came into force, an entirely different situation was created, as the following figures will show:—

	Factories.		Area in dessatines.
1895-96	231	....	320,900
1896-97	236	....	324,900
1897-98	239	....	367,700
1898-99	244	....	402,400
1899-1900	268	....	443,500
1900-01	275	....	485,200
1901-02	278	....	500,100
1902-03	278	....	529,900
1903-04	275	....	493,500
1904-05	278	....	431,100

We thus see that within the period, 1895-1904, the area under beets increased from 321,000 to 431,000 dessatines or 34%. This augmentation is partly due to a rise in the number of factories in operation, from 231 to 278 or 20%, and partly to an increase in production on the part of the already existing concerns. The Law of November, 1895, gave a fillip to the industry and led to the erection of new factories as well as to an increase in the sowings. Only the years 1903-04 and 1904-05 form exceptions. In 1905-06 485,000 dessatines were planted with beets, and the number of factories totalled 280. In the 1906-07 campaign these numbers increased further to 540,000 and 281 respectively. Ziechanowski holds that with the introduction of sounder commercial and financial conditions in Russia, her sugar industry will make yet greater progress under the protection of the existing laws. Indeed the conditions of the current campaign show that the increase in acreage in the 1906-07 campaign was not the maximum by any means. For the coming campaign, 565,000 dessatines of beets are being grown.

The majority of the Russian sugar factories obtain their raw material not only from fields of their own but also from outside quarters, partly from landowners and partly from well-to-do peasants. In order to obtain the best raw material, the sugar factories supply the contracting agriculturists gratis with sufficient beet seed of the best quality (either home grown or imported) to meet the requirements of the contracted area. About the year 1899-1900 the cultivation undertaken by the factories themselves amounted to little more than one-third of the total, the remaining two-thirds being due to outside agriculturists. In certain districts however considerable variations from this average are recorded. Thus in the Vistula provinces factory cultivation was almost entirely lacking. This is accounted for by the proportionally high degree of efficiency to which the Polish husbandry have attained, so that the factories can content themselves with very little cultivation on their own account. On the other hand the factory cultivation predominates in the black soil districts, while in the case of the factories in the south-west the cultivation is equally divided.

The beet harvest during the last twelve years has been as follows:—

	Roots per dessatine. Poods.	Sugar per dessatine. Poods.
1895-96	1,046	121·6
1896-97	1,080	121·2
1897-98	989	106·6
1898-99	914	101·9
1899-1900	1,006	108·7
1900-01	818	100·5
1901-02	1,009	117·0
1902-03	1,014	121·1
1903-04	953	128 4
1904-05	925	121·3
1905-06	960	117·4
1906-07	1,205	138·4

The campaign of 1906-07 was a record one, inasmuch as the yield in sugar exceeded the previous highest by 7·82%. This is accounted for by the exceptionally favourable weather experienced during the period of vegetation.

As regards the question of labour and wages, the following particulars will be found of interest.

As a rule only local labour is employed at the factories and very few workers come from other provinces. The greatest need for labour arises in the Autumn and Winter, when the peasants have finished harvesting. As however the work in the factory does not interfere with the agricultural pursuits of the labourer, his position as an independent agriculturist is not endangered.

The cost of labour per dessatine of beets varies from 60 to 100 roubles according to the district. At the Bobrin factory, for example, an average rate of 81·90 roubles per dessatine (£4 16s. per acre) is paid for labour, and at the Charitonenko factory 78·85 roubles is the cost, of which the details are as follows:—

	Roubles.
Manuring	2 65
Ploughing	2·00
Sowing and rolling	0·75
Thinning out	2·28
First hoeing	8·02
Second hoeing	1·05
Destruction of Pests	1·05
Rooting out (for a crop of 1270 berk.)	16·00
Transport, &c., per dessatine	44·85
	78·65

If, therefore, we reckon the cost for labour in Russian beet fields from seed time till harvest to be on the average 80 roubles per dessatine we shall not be far wide of the mark. As Ziechanowski points out,

the outlay in wages for labour is incomparably higher in Germany, where 226·35 roubles per hectare is the average. Bearing in mind that the hectare is somewhat smaller than the dessatine, we find the outlay in Germany is three times as high as the corresponding Russian one.

For the Russian sugar industry the question of the cost of production has an exceptionally important significance, since, as a fixed amount of sugar is placed on the market, the selling price of the product is regulated by various Government decrees which have to be taken into consideration by the factories. As the regulations aim amongst other things at cheapening the supply of sugar for home consumption by means of a reduction in the market price, it is clear that a corresponding reduction in the cost of production must be achieved, otherwise the sugar will be turned out at a loss.

This cost of production is based on the cost of the raw material and the working costs up to the time the sugar is ready for delivery. In estimating the value of the raw material, its quality and the output play no small part. As regards the output, Russian beet agriculture still leaves much to be desired; the quantitative and qualitative yields of different years show appreciable variations. This difference is still more pronounced in the case of individual factories, as here local conditions play an important rôle. There can, therefore, be no question of a single value for beets. In 1904-05 for example, the value of a berkovitz (berkovitz of 12 poods) of beets was at the sugar factories of the Warsaw province 1·67 to 1·91 roubles, of Kalish 1·50 to 1·76 roubles, of Kursk 1·40 to 1·49 roubles, of Tula 1·58 roubles, of Podolia 1·23 to 1·85 roubles, and of Tchernikov 1·30 to 1·87 roubles. One can, therefore, generally speaking conclude that during the above-mentioned period the beets cost at the factories under differing conditions 1·25 to 1·60 roubles per 12-pood berkowitz, and that the figure of 1·75 to 1·80 was only reached in isolated instances. But in 1905-06 the beets became dearer owing to a rise in the price of labour following on a strike of field labourers.

If the figures just cited are taken into consideration we shall find that the price of roots during 1905-06 was from 1·45 to 2·00 roubles per twelve poods (about 1·60 to 2·20 marks per 100 kg. or 9d. to 1s. 1d. per cwt.). If one then knows the price of roots and assumes, what is generally the case in actual practice, that the cost of production is only slightly less than the cost of the raw material, one can easily estimate the cost of a pood of sugar. It is, however, necessary to know the output of the particular factory. If a berkovitz (10 poods) of roots cost the factory 1·20 roubles and the output is 40 lbs. (Russian) of sugar, then the sugar costs the factory 2·40 roubles per pood. If the output be 50 lbs. of sugar, the cost of production is reduced to 1·92 roubles per pood of sugar, and if 60 lbs. to 1·60 roubles. Hence, given the same price for roots, the sugar costs the factory less, the higher the sugar content of the raw material is.

Thanks to the improvement in working methods, the sugar factories are now-a-days in a position to extract 35 to 45% more sugar from the roots than was the case 25 years ago. If, however, we glance back at the figures of output of single factories we see to what an extent these have varied. Thus in 1904-05 when the average output in all Russia was 13·1% or 52·5 lbs. per berkovitz of roots, a sugar factory in the Kieff province obtained only 38·7 lbs. of sugar, while another factory in the Kharhov province yielded 72·1 lbs. Even in the same province differences are quite as striking. Thus if we take Warsaw where beet culture stands on an exceptionally high level, we find that in 1904-05, for instance, one factory got 45 lbs. per berk., another 46·2, and two others 60 and 62·5 lbs. respectively. In Kieff one factory obtained 38·7 lbs. (the minimum for the whole country) and another lying only 40 to 50 versts (50 versts = 33 miles) distant had 58·6 lbs. to its credit, in spite of the fact that the first factory carried on a model system of beet culture. It is thus clear that the cost of production of a pood of sugar shows many a variation, not only as regards the average of a given campaign but for a single factory as well. In 1904-05 the pood cost in most factories 1·72 roubles but in certain cases the figure was widely different. There were factories which produced sugar at 1·35 roubles while in the Polish provinces there were none doing better than 2 roubles and some expended 2·30. In 1905-06 the cost of production rose some 32 to 25 kopecks per pood on account of unfavourable industrial conditions (*e.g.*, dearer beets, fuel and lime, linen, higher wages and credits). [It should be noted in making a comparison with German statistics that it is not the cost of producing raw sugar, but white sugar, which has been set forth above; this is a highly paying product which goes direct into consumption.]

Before concluding, some further figures of the labour employed may be conveniently given. As already mentioned, the sugar factories obtain their supply of labour chiefly from their immediate neighbourhood and only to a minor extent look further afield. During the 1905-06 campaign about 170,000 persons were employed in the whole of the Russian factories, of whom 14,000 were skilled workers and 156,000 day labourers (118,000 local labour and 35,000 imported from other localities). The average for each factory was over 500. A large number of the workers consist of women and young persons. The women naturally have the lighter jobs such as cleaning, washing the filter-press cloths, &c., and the young persons are employed in minding machines and other easy jobs. In 1905-06, 125,000 of the day labourers were men, 52,000 women, and 5,000 children.

The daily wages in most factories during 1904-05 stood at 30 to 60 kopecks for males (1s. to 2s. per diem), and 25 to 35 kopecks for females. Young persons received from 20 to 32 kopecks. Skilled workers received from ·55 kopecks to 1·67 roubles. In 1905-06 all these wages were raised slightly owing to strikes.

ON THE TREATMENT OF SACCHARINE JUICES AND MOLASSES WITH CALCIUM AND ALUMINIUM SILICATES, THE NATURE AND PROPERTIES OF THE RESULTING SYRUPS, AND THE SOLUBILITY OF THE CONTAINED SUGARS.

By Dr. H. Claassen.

The treatment of impure saccharine solution with silicates, as recommended by Harms and Rümpler a long time ago, has been revised and greatly improved by Gans. By employing the double silicate of calcium and aluminium in a granular form, the interchange between the calcium of the silicate and the potash of the juice is much accelerated and is almost instantaneous when hot; moreover, the original composition of the silicate is easily restored by passing a solution of calcium chloride through it.

This double silicate is manufactured by the firm of J. D. Riedel, of Berlin, under the name of *permutit*, and both a calcium and a sodium-permutit have been placed on the market; and I am indebted to this firm for a large supply of this product with which to carry out my experiments.

Such experiments seemed to me to be of general interest since, by means of this silicate it became possible to substitute calcium for potash in syrups and juices. Comparative experiments were thus available for observing what difference in quality existed between a syrup in which the potassium had been replaced by an equivalent quantity of calcium and the same syrup untreated.

During the discussion on Harms' process at the General Assembly at Köln I drew attention to this property of the silicate and the desirability of a more detailed investigation in order to ascertain whether such substitution was advantageous.

Both Harms and Rümpler claimed for the new process a more thorough purification of the juices. Rümpler found that by filtering a molasses of 60·52 purity through an artificial silicate, composed of cement, diatomaceous earth and ochre, the increase in the purity of the first filtrate was more than 7·00. The potash content (of the ash) was 92·25 per cent., the ash 40·10 per cent., and the total non-sugars amounted to 28 per cent., while the amount of lime increased from 0·334 parts to 3·892 parts per 100 of sugar. Although this result was quite incomprehensible in theory, Rümpler did not repeat his experiments, at least on any practical scale, neither did he undertake any investigations on the whole filtrate including the sweetening matters. Kohler also made investigations with Rümpler's silicate and recorded a decrease in the viscosity and an increase in the crystallization.

Gans has so far only undertaken very imperfect investigations with his silicates. Both the filtered juices and the filtered molasses showed an improvement in colour and an increase in crystallization, but the establishment of the latter point was so uncertain that hardly any value can be attached to it. Neither was the analysis of the product carried out in any more thorough manner, inasmuch as it consisted merely in estimating the amounts of potash and soda replaced by lime.

The whole question was therefore left unsettled, and it seemed a risky proceeding to carry out experiments on a large scale on the strength of such purely theoretical results. The necessary investigations could be carried out extensively yet economically by means of laboratory experiments, provided that the necessary boiling and crystallizing apparatus were available. As these problems interested me (in connection with experiments on the solubility of sugars in syrups rich in lime salts), I have studied them in the following manner in conjunction with my colleague Dr. Freist.

The calcium *permutit* kindly supplied me by the firm of Riedel is a greyish-white, granular product which is used in the filter in layers 50 cm. thick. It has been recommended that the juice should have a temperature of 60°-70° and pass through the filter with a velocity of 200 mm. per minute. The amount of *permutit* which should be employed for a given quantity of sugar solution can be found from the formula $\frac{\text{ash \%} \times 100}{12}$ in which the ash percentage is reckoned as K_2O. When the required amount of juice has passed through the filter, the latter is washed free from juice, and the *permutit* can then be at once restored to its original composition by passing a solution of chloride of calcium through it. The amount of the chloride needed is calculated from the formula $\frac{2 \times 111 \times \cdot 8 \text{ ash}}{94}$ so that, roughly speaking, twice as much $CaCl_2$ is taken as there was K_2O in the original juice. In our experiments we always used an excessive quantity of calcium chloride in order to be certain of complete restoration, and with satisfactory results. This revivification process and the solutions obtained therefrom were not specially investigated.

The Experimental Method Adopted.

Solutions of molasses and masse-cuite first-products were taken for filtration. The molasses were diluted with an equal quantity of water, and the masse-cuite dissolved to a strength of 40 Brix. The solutions were then warmed up to 85° and filtered through filter paper, so as to prepare a perfectly clear solution for the experiments. The solutions filtered over *permutit* were likewise filtered through paper to remove any traces of silicate. The filter was constructed of

sheet tin, cylindrical in form, but tapered at the lower end and there united to an exit pipe. To this latter was attached an india-rubber tube with a tap. Resting upon the top of the conical part was fixed a piece of perforated centrifugal lining which served to support the layer of *permutit*. The filter used for the molasses solution was 650 mm. high and 90 mm. in diameter, while that for the masse-cuite solution was 600 mm. high and 50 mm. in diameter. To prevent any cooling of the solutions the filters were wrapped externally with flannel. The *permutit* was introduced to a depth of 50 cm.; for the larger filter 2 kg. was required, for the smaller about ½ kg.

Previous to filtering, the filter was treated with hot water so as to warm the *permutit;* for the larger apparatus about 2½ litres was found sufficient for the purpose. As soon as the water was all drawn off and the tap closed, the hot sugar solution was introduced and was allowed to remain therein for about 15 minutes, after which the tap was opened, so as to let the filtration proceed. At the same time fresh solution was introduced above as fast as it drained off below, thereby ensuring that the *permutit* remained covered.

The larger filter had a capacity for 8 kg. of diluted molasses = 4 kg. of original molasses, and the smaller one held 2 kg. of masse-cuite solution. The amounts were calculated after the above-mentioned formula. They passed through the filter in from 1 to 1½ hours; the filtration was thus carried out much more slowly than is the usual custom. The issuing solution had a temperature of 65°.

In order to observe the progress of the treatment, small samples were withdrawn at intervals and treated with ammonium oxalate. These tests indicated an appreciable lime content as compared with the original solution, but it was almost, if not quite, impossible to control the process in this manner. We therefore required to filter only the above-mentioned quantities. As soon as the whole of the solution had passed off and the filter was empty, it was washed with hot water till the issuing fluid was hardly coloured at all; 2½ litres of water being generally enough. The wash water was then added to the filtered solution.

As the *permutit* available only sufficed for filling the filter once and had been used for the preliminary experiments, it had to be revivified for the experiments proper. This was done immediately after the juice had been washed out by filtering a hot solution of calcium chloride through the *permutit*. The filter was filled with this and the solution retained for half an hour, before it was drawn off. On repeating this operation, the filtrate showed a very strong lime reaction, a sign that no more calcium was being absorbed and that all potash was washed out. The filter was then further washed with hot water till the wash water showed no lime reaction.

Preliminary experiments showed that the filtration through revivified *permutit* proceeded very slowly, and that it was necessary to empty the *permutit* out and to replace it each time it was revivified, in order that the rate of filtration might be normal. It was noted that somewhat less of the revivified matter could be inserted than of the original substance, which showed that a slight increase in volume resulted from the revivification.

Behaviour of the Filtered Solution when Heated.

Both the solution filtered through the special filter and that simultaneously filtered through paper alone were introduced into a small steam-heated vacuum apparatus and concentrated. The apparatus employed was the one I used in my experiments on the estimation of the boiling points of sugar solutions, save that it was fitted with a dome so as to work with a vacuum. The latter was produced by means of a filter-pump and was not very high, corresponding at the most to about 40 cm. of mercury. The steam which acted on a double-bottom heating surface of 450 sq. cm. was of about 50 lbs. pressure and had a temperature of 147°. The difference in temperature between the steam and the boiling solution was thus at least 50°.

In this apparatus the solutions of molasses and masse-cuite, filtered through paper, could be concentrated in the usual manner without much scum formation. The masse-cuite was easily crystallized out and the molasses reduced to a water content of 10%.

But the solutions filtered through *permutit* frothed very strongly although steam was introduced through a perforated worm to facilitate boiling; this frothing was more marked in the case of the masse-cuite solution than of the molasses one. The steam introduced into the double-bottom had to be regulated with great care and the dome had to be enlarged in order to provide more top space.

In this way it was finally possible to evaporate the solutions but only to a certain water-content. As soon as the molasses were concentrated to about 25% water and the masse-cuite solution to about 28% water, no further concentration could be obtained, even by heating for hours and using an open steam pipe to obtain a strong and steady agitation of the liquid.

If the juices treated with *permutit* were boiled in the factory evaporators the reason for all this might be ascertained. It is quite possible that the juices will concentrate better in apparatus with large heating surfaces because tubes transmit heat better than does a double-bottom. But it is certain that the conducting power of the juices towards heat is very much affected by filtration through *permutit*. These juices or syrups will therefore concentrate slowly, and one has

to reckon with the possibility of not being able to concentrate them sufficiently. When concentrated, the syrups will be very difficult to boil and will probably not thicken sufficiently to allow the sugar to crystallize out completely leaving a residue of as low a purity as molasses.

As it was necessary for the purposes of our experiments to further reduce the water-content of these treated solutions, so that crystallization might be complete, they were further concentrated in flat dishes on a sand bath with constant stirring; it was thereby possible to concentrate them to a water-content of about 15% without decomposition occurring.

Chemical Changes in the Solutions Filtered over Calcium and Aluminium Silicates.

As already mentioned, the experiments consisted in diluting large quantities of masse-cuite or molasses with water, and then filtering one-half over *permutit*, the other half through filter paper, after which the solutions were boiled. There were thus obtained two identical liquids produced by one and the same method save that the filtering medium differed, and, from the analysis of each, conclusions could be drawn as to the changes in composition and inherent properties due to the alternative methods of filtration. The analysis of the syrups was carried out in the usual manner save that the ash was weighed in the form of carbonates, and the lime-content of the ash determined gravimetrically.

Analysis of Concentrated Masse-cuite Solutions.

	Filtered through	
	Paper. Per cent.	Permutit. Per cent.
Polarization	76·4	65·2
Water	15·3	27·9
Ash (carbonated)	3·10	2·13
,, (sulphated)	(3·21)	(2·45)
Organic non-sugar	5·20	4·81
Purity	90·2	90·4
Lime (gravimetric)	0·19	0·66
Alkalinity	0·02	0·006
Per 100 Dry Substance.		
Polarization	90·2	90·4
Ash (carbonated)	3·66	2·95
Organic non-sugar	6·14	6·67
Lime	0·22	0·91
Calcium carbonate	0·09	1·63

Analysis of Concentrated Molasses Solutions.

	Paper.	Filtered through Permutit. (a)	(b)
Polarization (direct)	52·5	50·0	51·3
,, (inversion)	51·5	49·1	—
Water	14·8	19·7	17·9
Ash (carbonated)	10·94	9·59	9·76
,, (sulphated)	(12·14)	(10·74)	—
Organic non-sugar	21·76	20·71	21·04
Purity	61·6	62·3	62·5
Lime (gravimetric)	0·89	2·43	2·6[illegible]
,, (volumetric)	(0·39)	(1·14)	—
Alkalinity	0·10	0·08	—
Per 100 Dry Substance.			
Sugar	61·6	62·3	62·5
Ash (carbonated)	12·84	11·94	11·89
Organic non-sugar	25·54	25·79	25·63
Lime	1·04	3·03	3·17
Calcium carbonate	1·86	5·41	5·66

The analyses show in the first place that only a portion of the alkali salts are transformed into lime salts. The lime in the masse-cuite has only increased 0·69 parts per 100 parts of dry substance. Assuming that potash alone has been replaced by lime (which is not always the case since soda may also be), then the 0·69 parts of lime correspond to 1·16 parts of potash. Out of the total ash of the masse-cuite about two-thirds may be considered as K_2O (Na_2O); or 2·4 parts per cent. of dry substance, and of this 1·16 parts or only about one-half are replaced by lime.

The same applies to the molasses. Per 100 parts of dry substance the filtered molasses had (*a*) 1·99, (*b*) 2·13 parts more lime than the original molasses, corresponding to a change of 3·35 parts K_2O in the case of (*a*), and 3·57 parts in the case of (*b*), while the alkali content of the original molasses was slightly over 8 parts out of the 12·8 parts of carbonate ash. Thus barely half the alkali of the molasses is removed.

The purity of the solutions filtered over *permutit* was somewhat increased, by 0·2 in the case of the masse-cuite, and by 0·7 and 0·9 in the case of the molasses. This increase in purity is not, however, to be attributed to the removal of non-sugar, but to the replacing of the alkali by lime, since one part of lime replaces 1·68 parts of potash and 1·11 parts of soda, and the weight of the ash is correspondingly reduced. It is only the ash content which is reduced, and not the content in organic non-sugars.

These results become more significant if one imagines the lime in the permutit-filtered solutions being substituted by potash. In the filtered masse-cuite there are 1·24 more parts of calcium carbonate

than in the original masse-cuite; which corresponds to 1·71 parts of potash carbonate. If this displaced potash be restored to the filtered masse-cuite, the amount of dry substance and ash will be increased by 1·71 — 1·24 = 0·47. From this we can calculate the composition of the original masse-cuite per 100 parts dry substance:—

	Calculated Composition.		Recorded Composition.
Polarization	90·0	....	90·2
Ash	3·40	....	3·66
Organic non-sugar	6·64	....	6·14

The filtered molasses contain in (*a*) 3·55 parts and in (*b*) 3·80 parts more calcium carbonate than the original molasses on 100 parts dry substance, corresponding to 4·90 and 5·24 parts of potash carbonate. On substituting potash for lime the quantities of ash and dry substance would be increased in molasses (*a*) by 1·35 parts and in molasses (*b*) by 1·44 parts. In 100 parts of dry substance there would then be:—

	Calculated Composition. (*a*) Per cent.		Calculated Composition. (*b*) Per cent.		Recorded Composition. Per cent.
Polarization	61·4	....	61·6	....	61·6
Ash	13·1	....	13·1	....	12·8
Organic non-sugar ..	25·4	....	25·3	....	25·5

That the calculated figures do not exactly correspond with the actual results is to be attributed to the fact that not only potash but also soda is replaced by lime; consequently the calculated ash may be too high, especially in the case of the molasses. But, in any case, it is quite clear that the filtration over *permutit* only causes an exchange of the alkalies—potash and soda with lime.

No other ingredient of the silicate, than potash, appears to pass into solution. In the filtered molasses only a trace of silicic acid (0·02%) could be detected, but this was also present in the original solution.

The analyses further show that no change in the alkalinity arises from the filtration. The small difference in the alkalinity is accounted for by the fact that the evaporation of the permutit-filtered solutions took a longer time to complete, so that their alkalinity was somewhat further decreased than was the case with the normal solutions.

That the efficiency of the revivified *permutit* remained undiminished is proved by the similarity of the molasses (*a*) and (*b*), which were each by itself filtered through freshly revivified *permutit*. The improvement in the colour, referred to by Gans, was not however noticed by us either in the masse-cuite or the molasses.

Whether the solutions filtered through *permutit* lend themselves better to treatment with lime and subsequent carbonatation, we have not attempted to discover.

(To be continued.)

COMPRESSED STEAM FOR EVAPORATING SACCHARINE LIQUIDS.

There are numerous advantages in using compressed steam for the evaporation of saccharine liquids. The idea is not new, for Piccard and Weibel have their machines working at several factories in France and Germany. In one special case there are eight hydraulic turbines of 100 h.p., each of which works a compressor. In Austria and Prussia there are two appliances working in connection with a triple effect, the heating surface of the first compartment being the largest. A piston compressor draws off a portion of the steam formed in the first compartment, and forces it into the heating chamber of this same compartment. The apparatus taken collectively will evaporate 4·5 kilos of water per kilogram of steam consumed. Its colossal size has prevented its general adoption. For a 200-ton plant, which is several times smaller than those now built, the diameter of the compressing cylinder is 0·922 m., steam cylinder 0·380, stroke 0·8 m., and the revolutions 50 a minute. In all the most modern evaporators there is an enormous amount of heat lost in the vapours that pass through the condensers. As early as 1857 an apparatus consisting of one boiler heated by steam at a temperature of 125° C., the liquor being concentrated, gave vapours at 110° C. These were drawn off by a piston compressor, then compressed and forced back at a pressure corresponding to 125° in the heating chamber of the boiler. The evaporation was consequently accomplished through the expenditure of mechanical energy only furnished to the compressor to carry the heat from the steam to the heating chamber. The first application of this mode of hydraulic power was used, and this needed no fuel expenditure.

The Piccard and Weibel idea is based upon the following principle: If steam is compressed it becomes superheated, and its temperature rises in direct ratio with the pressure if the steam is supersaturated before being compressed. If, on the other hand, it contains liquid particles in suspension, a portion of these will be evaporated during the compression. The compressed vapour may continue to be saturated if the pressure is not pushed beyond a certain limit. Messrs. Prache and Bouillon give an excellent analysis of the phenomena that take place during steam compression. They take, for example, an ordinary boiler which is heated by steam at 108° C., and it is supposed that the vapour liberated is at 100° C. It is further admitted that the liquid to be evaporated enters the boiler at 95° C. One kilogram of steam used for heating, through its condensation, will evaporate one kilo of water, yielding one kilo of steam at 100° C. It is also well known that:—

One kilo of saturated steam at 108° C. is at a pressure of 1·366 kilos and contains 639·45 calories.

One kilo of saturated steam at 100° C. is at a pressure of 1·033 kilos and contains 637 calories.

From which facts one may conclude that between one kilo of saturated steam at 108° C. and one kilo of steam at 100° there is a difference of pressure of

$$1{\cdot}366 - 1{\cdot}033 = 0{\cdot}333 \text{ kilo},$$

and a difference of total heat contained of

$$639{\cdot}45 - 637{\cdot}00 = 2{\cdot}45 \text{ calories}.$$

In thermodynamics it is shown that in order to transform through saturated steam compression at 108° C. a weight of moist steam at 100° C. consisting of one kilo of saturated vapour and 0·015 water vesicles, it is necessary that there be an expenditure of work corresponding to 9·64 calories. This difference, 9·64 — 2·45 = 7·19 calories, comes from the work needed for the evaporation of 0·015 kilo of water vesicles; this vaporization means a loss of liberated heat to the steam compression. It follows that each 1·015 kilos of compressed steam at 108° C. will bring with it an excess of heat over that of the original steam of 7·19 calories, which means a recuperation of most of the energy expended for the work of compressing. These 7·19 calories will compensate for losses caused by radiation during the period the liquid is being carried from one place to another and the period it is raised to its boiling point.

Attention is called to the fact that by this method the expenditure of the necessary energy to effect the evaporation, or, in other words, to produce the steam compression, is directly in proportion to the difference of pressure of the steam before and after the compression. Consequently it may be concluded that, in an apparatus working under this principle, the evaporation may theoretically be accomplished with an expenditure of energy as small as one wishes. The smaller the difference of pressure before and after compressing, the larger must be the boiler to evaporate a given quantity of water.—(*Sugar Beet.*)

From the first of this month the duties on sugar, treacle, and molasses, which have formed part of the New Zealand tariff, will cease to operate and the articles in question will henceforward enter that colony duty-free.

The jam manufacturers of Cape Colony are agitating for a rebate in the duties levied on imported sugar when such sugar is to be used for making jams and confectionery. It is however suggested that the distress in the trade which has been attributed to the existing system of taxation, is really due to the fact that there are too many such confectionery firms in the colony.

A CONTRIBUTION TO THE MATHEMATICAL STUDY OF CHEMICAL CONTROL IN BEET SUCRERIES.

By M. J. Robart.

Part I.—Theoretical.

Assuming an ideal case in which no loss of sugar occurs during manufacturing operations, and that the syrup and molasses have the following compositions:—

	Syrup.	Molasses.
Brix	60	80
Sucrose	54	48
Ash	2	10·667
Organic matters	4	21·333
Saline quotient	27	4·50
Purity	90	60
Ratio $\frac{\text{Organic matters}}{\text{Ash}}$	2	2

also, that 100 kilos. of beet, when worked up into syrup, represent 15 kilos. of sugar.

Under these conditions the yield, or recovery, of sugar per 100 kilos. of beets may be calculated by the various methods which follow, commencing with the two classical methods based respectively upon the purities of the syrup and molasses, and on the ratio of sugars to non-sugars in these products:—

(1.) From the purity (syrup = 90; molasses = 60):—

$$\frac{90 - 60}{100 - 60} \times \frac{15 \times 100}{90} = 12·5 \text{ kilos.}$$

(2.) From the ratio of sugars to non-sugars:—

(Non-sugars in syrup = 6, in molasses = 32)

Since 32 parts of non-sugars retains 48 parts of sugar in molasses,

6 parts of non-sugars retain $\frac{48 \times 6}{32} = 9$ parts of sugar in syrup,

and the yield per 100 kilos of sugar will be:—

$$\frac{100\ (54 - 9)}{54} = 83·333,$$

or, per 100 kilos of beets (representing 15 kilos of sugar):—

$$15 \times 0·83333 = 12·5 \text{ kilos.}$$

(3.) Next, we have the method based on the saline quotient (syrup = 27; molasses = 4·50):—

$$\frac{27 - 4·5}{27} \times 15 = 12·50 \text{ kilos.}$$

Or, adopting the argument employed above for the non-sugars:—

If 10·667 parts of ash retain 48 parts of sugar in the molasses,

2 parts of ash retain $\frac{48 \times 2}{10·667} = 9$ parts of ugar in the syrup,

and the yield per 100 kilos of beet will be :—

$$\frac{100\ (54 - 9)}{54} \times 15 = 12{\cdot}5 \textbf{ kilos.}$$

(4.) From the ratio of Non-sugars to Brix :—

$$\frac{\text{Brix of syrup}}{\text{Non-sugars in syrup}} = \frac{60}{6} = 10 \text{ Brix per 1 of Non-sugar.}$$

$$\frac{\text{Brix of molasses}}{\text{Non-sugars in molasses}} = \frac{80}{32} = 2{\cdot}50 \quad ,, \quad ,, \quad ,,$$

and $10 - 2{\cdot}5 = 7{\cdot}5$ on 10 Brix

$= 75$,, 100 ,,

and on 100 kilos of beets :—

$$\cdot75 \times \frac{15 \times 100}{90} = 12{\cdot}50 \textbf{ kilos.}$$

(5.) From the ratio of Ash to Brix, which forms the special subject of our memoir :—

$$\frac{\text{Brix of syrup}}{\text{Ash of syrup}} = \frac{60}{2} = 30.$$

$$\frac{\text{Brix of molasses}}{\text{Ash of molasses}} = \frac{80}{10{\cdot}667} = 7{\cdot}50$$

and $30 - 7{\cdot}5 = 22{\cdot}5$ on 30

$= 75$,, 100

and the yield per 100 kilos. of beets is, as before :—

$$75 \times \frac{15 \times 100}{90} = 12{\cdot}50 \textbf{ kilos.}$$

From the results obtained above it is evident that under the ideal conditions we have assumed, it does not matter which method of calculation is adopted. But in practice this is no longer true, because the losses which occur during manufacture tend to increase the ratio of ash to organic non-sugars progressively from the state of syrup to that of molasses, and thus disturbs the constitution of the various products derived from the same syrup. This has long been recognized, so that in adopting the first of the preceding formulae, it is necessary to deduct the actual working losses (both chemical and mechanical) which are by no means easily estimated. Yet we know of several usines where this plan is followed with very accurate results.

Our present object is to avoid a correction for chemical losses, and in order to solve this problem we shall apply the previous formulae to another case in which the composition of the syrup remains as before whilst the molasses show a ratio $\frac{\text{Organic matters}}{\text{Ash}}$ of 2·20 :—

	Syrup.		Molasses.
Brix	60	..	80
Sucrose	54	..	48
Ash	2	..	10
Organic Matters	4	..	22
Saline Quotient	27	..	4·8
Purity	90	..	60
Ratio $\frac{\text{Organic matters}}{\text{Ash}}$	2	..	2·2

On applying the preceding formulæ, we obtain:—

1.	From the purities	12·50
2.	From the ratio of sugars to non-sugars	12·50
3.	From the saline quotient, or ratio of ash to sugar	12·33
4.	From the ratio of non-sugars to Brix	12·50
5.	From the ratio of ash to Brix..	12·22

From the analytical data it is evident that the second sample of molasses is not so completely exhausted of sugar as the first, since the saline quotient is 4·8 instead of 4·5, and a given quantity of syrup will yield a larger quantity of molasses of 4·8 saline quotient than of 4·5, and the yield of sugar should, consequently, be less. Hence, the result obtained by the formulæ Nos. 1, 2, and 4 must be rejected. No. 3 also gives too high a result (12·33), since we know that some sugar is destroyed, causing a lower ratio of $\frac{\text{Sugar}}{\text{Ash}}$ in the molasses. In this case, the sugar which becomes inverted and then increases the ratio $\frac{\text{Organic matter}}{\text{Ash}}$, is reckoned as crystallizable sugar.

The formula No. 5, based on the ratio of ash to Brix and giving a result of 12·22, appears theoretically to be the most accurate expression of the facts.

On considering the four formulæ we have rejected, we find that the first, second, and fourth, are based on two factors—sugars and non-sugars—both of which vary during the progress of manufacture, the one diminishing while the other increases. In the third formula there is only one variable factor—the sugar—which explains the differences in the result obtained as compared with formulæ Nos. 1, 2, and 4.

But, in order to arrive at an accurate result, the formula must be based on two factors which shall remain constant during manufacturing operations, and believing that such factors are represented by the ash and the total solid matters (or Brix) we have carried out laboratory experiments in this direction.

Part II.—Practical.

From the results of our investigations on syrups and molasses, we are able to state the two following laws:—

1. That the total dissolved solid matter may be considered constant in a given saccharine product, even after considerable decomposition of the sugar has been brought about by heat, to a degree which is never met with in practice.

2. That the percentage of ash may also be regarded as constant for a given product.

But according to the different methods adopted for purifying the syrups and molasses (sulphitation and filtration), it may happen that

these two laws are not strictly true in every sucrerie. We therefore abstain from claiming that the dissolved total solid matters and mineral matters remain constant during the entire process of manufacture except in those usines where the syrups and molasses are not treated with chemicals.

Our experiments were conducted as follows:—Samples of syrup, centrifugal-washings, and molasses were concentrated to about 80° Brix in the laboratory, and were then heated in a closed copper vessel communicating with a vertical condenser. The syrups, &c., could thus be heated continuously without evaporation of the contained water which re-condensed as fast as it was vaporized, and flowed back to the copper boiler. Without this precaution, the action of heat would have become excessive as soon as the fluids had become too concentrated. The heating was continued for about eight hours, and samples were withdrawn for analysis at intervals. The analyses were made in duplicate and the ash determinations in triplicate. The following results were obtained when treating a sample of syrup of 60° Brix:—

	Concentrated Syrup.	After 2 hours' heating.	After 5 hours' heating.	After 8 hours' heating.
Brix apparent	81·64	81·64	81·64	81·84
Sucrose (direct polarization)	76·28	75·35	74·25	66·40
Ash	1·860	1·860	1·865	1·875
Organic matters	3·500	4·430	5·525	13·565
Saline quotient	41·01	40·51	39·81	35·41
Purity	93·43	92·19	90·05	81·13
Ratio $\frac{\text{Organic matters}}{\text{Ash}}$	1·88	2·38	2·96	7·23
Ratio $\frac{\text{Brix}}{\text{Ash}}$	43·89	43·89	43·78	43·65

It will be sufficient to state that these results were entirely confirmed by our other experiments.

Part III.—General Problems.

1. Total loss due to decomposition of the sugar.

The composition of the syrup and molasses being given as follows:—

	Syrup.	Molasses.
Brix	60	82
Sucrose	55·80	48
Ash	1·40	10·0
Organic matters	2·80	24·0
Saline quotient	39·84	4·80
Purity	93	58·54
Ratio $\frac{\text{Organic matters}}{\text{Ash}}$	2	2·4

Assuming, as before, that 100 kilos of beet yield 15 kilos of sugar in the state of syrup,

Calculating the ratio of $\frac{\text{Brix}}{\text{Ash}}$, we obtain 42·857 for the syrup and 8·20 for the molasses.

The yield per 100 kilos Brix is:—

$$\frac{42{\cdot}857 - 8{\cdot}20}{42{\cdot}857} = {\cdot}80866$$

And per 100 kilos of beets:—

$$\frac{80{\cdot}866}{100} \times \frac{15}{0{\cdot}93} = 13{\cdot}043 \text{ kilos.}$$

The sugar left in the molasses is calculated from the ash yielded by 100 kilos of beets in the state of syrup:—

$$\frac{1{\cdot}40 \times 15}{55{\cdot}80} = 0{\cdot}376 \text{ kilos ash,}$$

and by multiplying this weight of ash by the saline quotient of the molasses:—

$$4{\cdot}80 \times 0{\cdot}376 = 1{\cdot}805 \text{ kilos.}$$

Total sugar obtained = 13·043 + 1·805 = 14·848 kilos.

Total loss by decomposition:—

15 — 14·848 = 0·152 kilos per 100 kilos of beets.

2. Loss during boiling to masse-cuite.

The analytical data being as follows:—

	Syrup.	Washings.*	Masse-cuite.
Brix	60	75	90
Sucrose	55·80	57	78·30
Ash	1·40	5·625	3·60
Organic matters	2·80	12·375	8·10
Saline quotient	39·84	10·13	21·07
Purity	93	76	87
Ratio $\frac{\text{Organic matters}}{\text{Ash}}$	2	2·2	2·25

We first calculate the quantity of ash per 100 kilos. Brix in each product and obtain:—

Syrup = 2·333. Washings = 7·50. Masse-cuite = 4·00.

The quantity of syrup boiled to masse-cuite will be:—

$$\frac{7{\cdot}50 - 4}{7{\cdot}50 - 2{\cdot}333} = 67{\cdot}737\%.$$

The quantity of washings boiled to masse-cuite will be:—

$$\frac{4 - 2{\cdot}333}{7{\cdot}50 - 2{\cdot}333} = 32{\cdot}263\%.$$

Knowing the purities of these two products we may now calculate the purity (theoretical) of the masse-cuite:—

$$(67{\cdot}737 \times {\cdot}93) + (32{\cdot}263 \times {\cdot}76) = 87{\cdot}51$$

which would yield:—

$$\frac{87{\cdot}51 \times 90}{100} = 78{\cdot}76 \text{ of sugar per 100 kilos. of masse-cuite.}$$

* Washings from centrifugals, which are returned to the vacuum pan.

The polarization of the latter being 78·30, the loss per 100 kilos. of masse-cuite is:—78·76 — 78·30 = 0·46,
and the loss per 100 kilos. of sugar will be:—

$$\frac{0{\cdot}46 \times 100}{78{\cdot}76} = 0{\cdot}580 \text{ kilos.}$$

The mechanical losses, to which we have not referred, do not in any way modify the results obtained in these various calculations. They should appear as deductions from the theoretical yield of sugar, and not as deductions from the calculated losses.—(From *Bulletin des Chimistes.*)

A NEW WATER-DRIVEN CENTRIFUGAL.

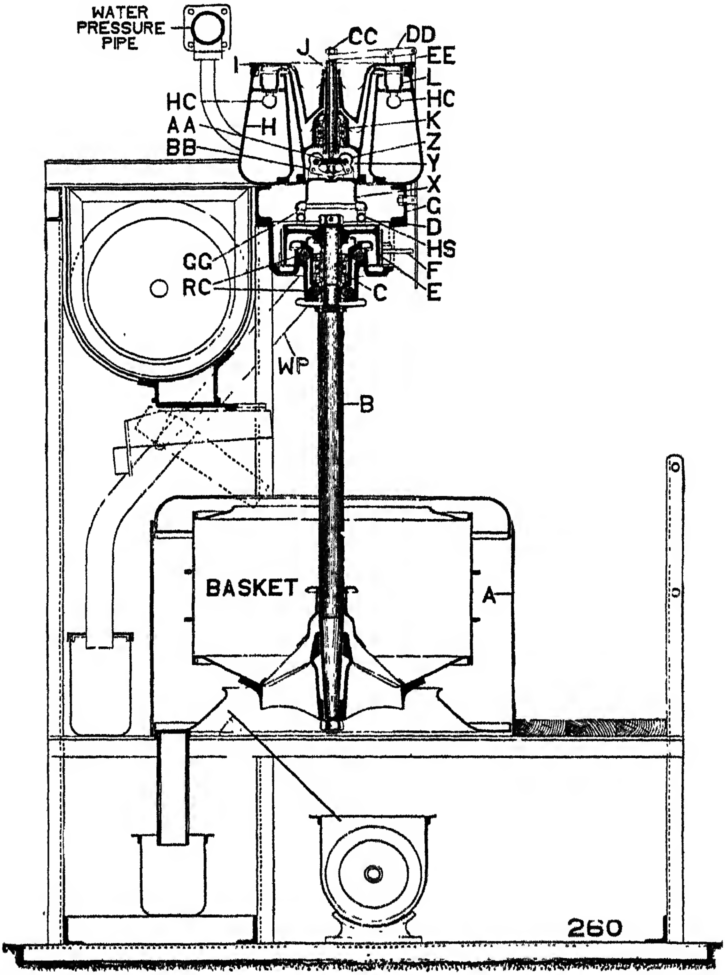
Messrs. Pott, Cassels and Williamson, of Motherwell, Glasgow, have recently placed on the market a new type of water-driven centrifugal of their own design and manufacture. As this forms a new departure in their practice, some description of their latest machine will not be out of place here. We therefore propose to give a brief description of the chief details of this centrifugal, which will be found illustrated in sectional elevation on the opposite page.

These centrifugals combine all the advantages of ball-bearings, solid spindles, self-adjusting buffers, &c., with easy and effective methods of lubrication. They are fitted with compound ball bearings, C, in conjunction with an arrangement of indiarubber buffers, RC, of the shape of an umbrella ring. It is claimed for this arrangement that it gives great resiliency and perfect steadiness of the machine when running with a balanced or unbalanced load. The ball-bearings and india-rubber rings can be removed without dismantling the machine.

The following are some of the advantages claimed for this machine by its designers:—

1. The water motor is complete in itself, and can be removed without disturbing the centrifugal.
2. The centrifugal can be removed without disturbing the motor.
3. The motors can be removed without affecting any of the other machines.
4. There are no baffles or brakes inside the motor case to cause trouble by splashing and interference with the free exit of water.
5. The cups of the wheel and the nozzles have always the same definite relation to each other, ensuring the best efficiency at all times.
6. The nozzles can be inspected and cleaned without opening up the motors.
7. The automatic cut-out is simple and not liable to derangement.
8. The brake for stopping the machine is outside the motor, and does not pull the basket to one side when stopping.

9. The governor is enclosed in a tight chamber, which is supplied with a quantity of non-acid oil, which, when the motor is started, rises up and flows into the ball bearings, but cannot escape over the top of the bearing.



10. The governor and ball bearings will run without any attention whatever for an indefinite period, the arrangement being such that neither water nor any other foreign matter can get into the oil chamber.

A brake pulley E is fitted to the top end of the spindle and is worked by a lever F. The motor case H consists of an annular cylindrical vessel open at the top but fitted with a cover I. A hollow stud J is fixed to the latter and is supported on a compound ball bearing K which acts as a journal and thrust to the water wheel L. Two jets M and N deliver the water to the hemispherical cups HC; jet M is the accelerating one and N is the maintaining jet. Each has its own valves and levers. At Z is placed an ordinary type of pendulum governor but fitted with helical springs AA to counteract the centrifugal force. It is connected by rods and levers with the accelerating valve. A helical spring HS forms a flexible coupling between the motor and the centrifugal.

In starting the machine both valves are opened by the movements of one lever, but as soon as full speed is reached, the governor acts on a trigger which releases a spring and causes the accelerating valve to close, leaving the maintaining valve alone at work.

We understand the 42 in. machine with a full load is accelerated to full speed in two minutes with the water flowing at the rate of 82 gallons per minute at 150 lbs. pressure per square inch, and that only 25 gallons per minute is required to maintain the machine at full speed, equal to 6·12 h.p. and 2·55 h.p. respectively, showing that this machine with its water wheel, which does not oscillate with the spindle, has a high efficiency.

THE EFFECTS ON THE HUMAN SYSTEM OF LOUISIANA MANUFACTURED SYRUPS AND MOLASSES.

The cane sugar syrups and molasses sold for consumption in Louisiana all contain a minute quantity of sulphur as sulphites and sulphates, owing to the sulphuring of the juice in the process of clarification; and of late years some question has arisen as to the evil effects of this sulphur on the consumer.

To settle the matter, Mr. D. D. Colcock, secretary of the Louisiana Sugar and Rice Exchange, recently proposed the carrying out of a scientific investigation of the effects on the human system of such feeding syrups and molasses. He laid his proposals before several leading experts, including Mr. McCall, President of the Planters' Association; Mr. Blouin, Assistant Director of the Sugar Experiment Station, and Dr. C. H. Irion, President of the Board of Health. These gentlemen promptly fell in with Mr. Colcock's suggestions and it was decided to select as subjects for feeding twelve negroes from amongst those undergoing short sentences in the local prison. The results of these experiments are given in detail in a recent number of the *Louisiana Planter*, and from it we cull the following particulars.

Negroes were selected owing to their well-known fondness for this class of food and to their entire ignorance of sulphites and the supposed effects of the latter on the human system. No system of forced feeding was employed; the subjects selected were taken from a large number of willing volunteers. The period of experimentation was five weeks, and for that time the men were kept in a separate building, and were allowed special privileges as compared with the ordinary prison routine. In fact it was intended to make the daily routine conform as closely as possible to the ordinary conditions of living met in the class of subjects under observation, with such additional sanitary and hygienic measures as seemed expedient. With this object in view the men were put to the same kind of work as they would have been engaged on when out of prison. They were allowed exercise at stated intervals in the day, and at night were permitted to indulge in indoor recreation, such as reading and playing cards.

The food supplied them was as clean and fresh as could be procured, and its cooking was supervised. No canned foods were allowed. Of the food placed on the table each subject was allowed to eat as he chose. The experiments were divided into five periods of one week each. During the first week the men were fed on a normal diet without any syrup or molasses, while during the second, third, and fourth weeks they were allowed syrup or molasses as they desired to eat of it along with their regular food. Observations were made during each period as to the effects produced.

The twelve subjects were divided into three squads of four each. Squad I. was fed during the Periods II., III., and IV. on genuine cane syrup. The content of sulphur as sulphites in this syrup was 405 milligrams per kilogram or ·04 per cent. Squad II. was fed during the same period on genuine open kettle molasses, containing normally 161 mg. per kg. of sulphur as sulphites. At the end of period II. this amount was increased by the addition of sodium sulphite sufficient to raise the sulphur content to 502 mg. Squad III. was fed during the three weeks on first vacuum pan molasses which contained 928 mg. of sulphur per kg.

Each subject was provided with a glass-stoppered syrup pitcher which was placed at his side at meal times. The amounts of syrup and molasses eaten were determined by weighing the pitchers before and after meals. It should be observed that there was no feeling of a duty amongst these negroes in eating the syrup and molasses, as each subject thoroughly understood that he was only to eat as much as his appetite demanded. As a matter of fact the squad attacked the syrup and molasses with a faith born of experience and ate them in surprisingly large quantities.

The conclusions drawn from all the experimental data taken in the course of the five weeks as supplied by the investigators to the Board of Health were as follows :—

(1) "From a practical standpoint the experiments on molasses feeding were carried on for a sufficient length of time and on a scale large enough to test the effects of these foods on the human subject in ordinary health.

(2) "We believe that our mode of examination is the fairest way to test the effects of substances on the human subject under natural conditions; for here we had a large number of docile and ignorant men who did not know what was expected of them, were neither frightened nor awed, and put in the same condition as persons who partake of molasses as a food; eating of the same according to their taste and liking, and the effects on them carefully and faithfully noted from day to day and week to week.

(3) "As in none of our cases were the body functions interfered with, in each one the body weight increased, and as the blood steadily increased in number of red blood cells, in the percentage of haemoglobin, etc., it must be admitted that these subjects were gaining in health and neither doing nor taking anything prejudicial to their physical well-being.

(4) "A careful survey of the weights recorded, and of the tables relating to blood examination, will satisfy anyone that the subjects gradually improved in weight, body functions and blood conditions, notwithstanding the fact that during Periods II., III., and. IV. they daily took a considerable quantity of syrup or molasses containing appreciable quantities of sulphur as sulphites.

"It is demonstrated that the amount of molasses consumed, although in some instances very large, does not seem to have had any deleterious effects on the functions, weight, and blood conditions of the subjects, but rather to the contrary.

"We are, therefore, free to conclude that molasses feeding, even when said molasses contains as much as over 900 milligrams per kilo of sulphur as sulphites, can be carried on under ordinary circumstances without prejudicial effect to health."

The prospects of the present season's crop in Demerara are not good. The canes have been suffering from the excessively dry weather and are thin, short and lacking in juice; but the juice itself is said to be of good quality.

BROOKE'S "PARALLEL FLOW" OIL SEPARATOR.

It is well-known that lubricating oil if allowed to pass into boiler feed-water constitutes a danger to boilers of so serious a nature that special apparatus has to be employed to ensure its separation and removal. Filtration is sometimes tried but requires a good deal of attention if the filter is to be kept in order, while chemical treatment is apt to prove expensive.

The best method is undoubtedly mechanical separation before the steam enters the condenser, as in that case the oil and grease are not deposited on the condenser tubes thereby retarding the cooling process.

The best system of mechanical separator is manifestly that which gives the steam the largest amount of extracting surface to traverse while at the same time avoiding any tendency to back pressure. Messrs. Holden & Brooke of Gorton, Manchester, have during the last few years introduced important improvements in their well known and largely used separators and their present system which we illustrate below in sectional plan (Fig. 1) is now, as the result of an extensive practical experience, highly perfected.

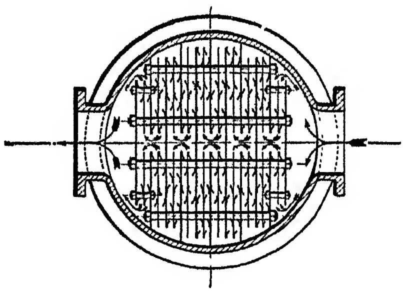


FIG. 1.

In it the steam is led between the walls of a number of vertical passages in parallel. These walls which form the depositing surfaces are provided at frequent intervals with vertical channels to catch and lead the grease downwards to the collecting chamber. They are continuous and consequently keep the steam also under a continuous cleansing process, while the area the steam is brought into contact with is claimed to be fully ten times as great as in the ordinary methods employed. Some other advantages claimed for this design are :—

1. Each particle of the steam is carried along the entire length of the depositing surface, and not merely over a fractional portion of the surface provided as in other systems.

2. The separating and extracting process works continuously on the steam throughout its entire course through the separator.

3. Ample internal area for expansion without being of unreasonable or unwieldy size.

4. No part of the separator can become clogged or ineffective by grease deposit.

5. The oil and grease extracted and deposited can always get freely away.

6. The separator is self-cleansing.

The makers guarantee that the condensation water so treated shall not contain more than 0·5 grain of oil per gallon or one-half the safe limit for boiler feed, but as a matter of fact the amount of oil contained in the water often comes out in analysis to be under ·2 grain per gallon.

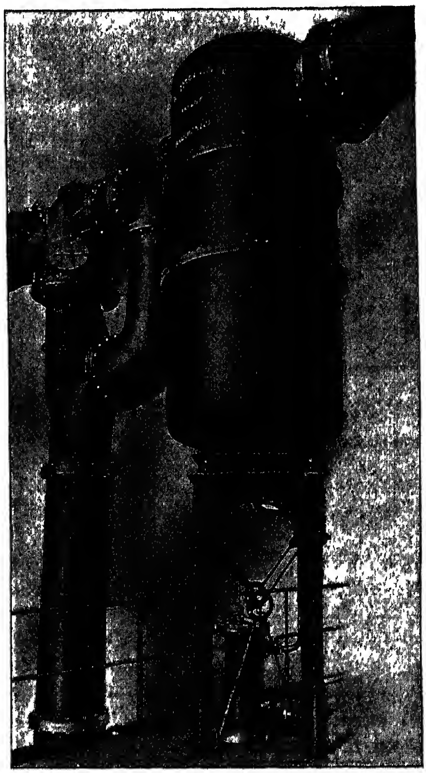


Fig. 2.

Fig. 2 illustrates an Oil Separator supplied to an electric light station and capable of dealing with 45,000 lbs. of exhaust steam per hour. This capacity has however been greatly exceeded in a more recent order which was for a plant to deal with 178,000 lbs. per hour.

THE SELECTION OF SUGAR CANE CUTTINGS.

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(Abridged from the *Agricultural Journal of India.*)

The losses caused by diseases of the sugar cane are yearly attracting more and more attention in every cane-growing country, and it is gradually becoming recognised that the question of their prevention is one of the chief problems that sugar cane planters have to face. This is not less the case in India than elsewhere, for a number of sugar cane diseases are already known in this country, and one of them—red rot or red smut—is the cause of very great damage to the crop in many places.

Red rot is caused by a minute fungus, *Colletotrichum falcatum* Went, which grows in the cane pith, producing a red discolouration of the latter. The red markings are peculiar in some respects, and are sufficient to enable any one with a little practice to recognize the disease. The first point to be observed is that the discolouration does not affect the whole of the pith uniformly. It has a tendency to appear in sharply marked streaks or lines, these indicating, for the most part, the fibres which run along the pith and contain the water vessels of the plant. The colouration is usually greatest at the nodes or joints, and less, but still visible in streaks, between the joints. Here and there white patches surrounded with a red ring are visible, and it is noticeable that these patches extend across the cane, not along it. None of the other injuries to cane, which cause reddening of the pith, produce these white patches, and their presence in any cane is an infallible sign that it is attacked by red rot.

In the first stage there is not usually much indication of the disease on the outside of the cane, which is still full and rigid. When drying up occurs, however, the cane collapses between the joints and shows long wrinkles where it has fallen in; at the same time it becomes soft or brittle and can easily be bent or broken off. Early in this second stage a number of little black dots appear on the surface and the fungus comes to light. These dots, which are the spore beds, collect chiefly at the joints, but also appear in the wrinkled parts between. They are often rare or hard to find, and are so small that the use of a lens is necessary to see them clearly.

The spores that are formed in these black spore beds can germinate if sown on nutriment jelly or even in moist earth, and produce a mould-like growth of the fungus on the surface. A little of this inserted into the pith of a healthy cane can set up red rot and quickly lead to the discolouration of a small patch of the neighbouring pith. Hence the fungus is a parasite which can live in the soil or on

decaying leaves in the fields, when it has no sugar cane to feed on. Just how long it can survive away from the cane is not known, but there is evidence to show that, ordinarily, three or four months is enough to cause its disappearance from the soil.

It is, of course, evident that the spores, instead of falling on the soil, may lodge on healthy canes near by and infect them directly. This would be extremely common, no doubt, but for the fact that the cane rind offers a barrier which the fungus is unable to pass. Hence to reach the pith and set up red rot, it must fall on some broken or damaged part of the rind. Unfortunately, as everyone knows, the cane rind is frequently damaged, either by the holes of borer insects, or by cracks that form naturally in many varieties while the cane is ripening. If the spores fall into these wounds, a small patch of red rot is set up, sometimes of sufficient severity to kill the particular cane affected.

In some parts of India, as in the Godaveri Delta, this death of single canes in a stool from the entry of the parasite through a wound is common. Most cane fields show a number of such cases. In other parts of India as in Behar, it is not so common. This is possibly due to the drier climate of these parts after October, when the spore production of the fungus begins. It is extremely rare in Behar to find any spores before November, and it is possible that, at this time, the natural conditions are such that, even should spores be blown on to a wounded cane, they cannot germinate or grow with sufficient vigour to cause the death of the cane. If so, then the past year must have been abnormal in some respects, for a large number of wound infections occurred at Pusa, though as previously said they are not usually common in this part of the country.

Now, there is another aspect of the matter to be considered. Sugar cane is usually grown from sets or cuttings, not from seed. It is evident that amongst these cuttings some will have the rind broken by wounds. Some of these damaged sets will have been infected by red rot as just described, and the set will be planted out *with the parasite in it.* Further, if infection of the wounded cane has occurred sufficiently early in the season, the fungus may have extended two or three feet along the cane (producing always the red discolouration of the pith), and not one, but three or four, diseased sets may be planted from a single infected cane. Of course, if the infection were very severe, the cane would be dead at planting time and would not be used for seed; but a large number of the canes at planting time will be just sufficiently infected to show the discolouration, but will still look healthy externally and be quite juicy, so that, unless the reddening is accepted as a danger signal, they will be planted.

An instance of what this may result in is shown in the following. Alternate rows of reddened and unreddened sets of Madras cane, known as *yerra*, were sown at Pusa in 1906. The unreddened sets

germinated well and gave a promising-looking crop. The reddened ones on the other hand germinated badly, and even of those that did come up, a number died in the following two or three months. On digging these up and examining them, it was found that the parasite had grown into the new shoots and killed them. It is probable that many of the sets which fail to germinate, and which are usually said to be killed by white ants, are really killed by red rot, and the white ants are merely followers that feed on the dead cane.

Very often it happens that the red rot fungus, though present in the planted set, fails to kill the young shoots on germination. Why this should be is difficult to say, as it is one of those mysteries connected with the struggle between host and parasite, about which we are still very much in the dark. Sometimes the parasite gets the upper hand and kills the young plant; sometimes the young plant is too strong for the parasite and keeps it in check. However, even in this latter case, the parasite is not got rid of, but merely remains dormant in the stool. As the cane begins to contain an appreciable quantity of sugar, the fungus resumes its growth, and will be found flourishing very vigorously about September or October in Behar. Hence, about this time, numbers of cane clumps begin to show signs of disease. The fungus is now attacking the most vital part of the cane, the base of the stool, and spreading from here into each individual cane. One after another each cane in the stool withers, the oldest first, until the whole clump is destroyed. This is the form of the disease with which every planter in Behar is familiar, and the point which I wish to emphasize is that spore infection in the particular year has nothing whatever to do with it, for when it begins, there are scarcely any spores about; it is the result of planting sets containing the parasite already within them.

It may be asked, in regard to this, whether spores from the soil may not attack the growing crop. Apart from the fact that the spores do not live long in the soil, this has been shown by another experiment not to occur commonly. Pieces of land that had borne a diseased crop the previous year, and consequently were plentifully charged with spores, were replanted with healthy seed. Even when the variety used was one that is subject to the disease and was, therefore, not a naturally immune kind, no appreciable disease resulted.

The effect of rattooning diseased cane may be anticipated from what has been said. Where disease has been severe, a large number of the stools left in the ground after cutting the crop, will contain the fungus. This has been proved by actual observation. When the second crop grows from these stools, the fungus may, as already said, remain dormant for some months. But, as the cane matures, the parasite resumes activity, and gradually clump after clump withers. An extreme case of this may be mentioned. The diseased variety

yerra was rattooned at Pusa along with other varieties in 1906. The previous crop had been very badly diseased. In spite of this the rattoons grew fairly well at first. But during the subsequent monsoon they began to wither and finally all died out. The variety occupied a long narrow plot in the middle of the other rattooned varieties. As the latter remained healthy, the appearance of the diseased plot was as if a road had been cleared right through the cane field.

Now, all this makes it clear that the examination of the cuttings for red rot at the time of planting is a very important matter. Almost every cane field contains some plants attacked by red rot. It is not possible absolutely to prevent its appearance. The spores cannot all be destroyed, do what we may. Disease in plants, as in man, can never be entirely exterminated, but it can be checked and prevented from becoming epidemic. That is all we require to aim at —to keep it down within reasonable limits. Of all the precautions which can be taken to check cane diseases, the most important is the selection and examination of the seed. It should be as essential a part of the routine practice in planting as the preparation of the soil.

To this it may be objected that in some places, and with some cane varieties, there is no disease, and seed examination for red rot is just so much waste of time. This is a very dangerous argument. It is extremely difficult to say, without examining the sets, whether disease is present or not. No variety of cane, so far as is known, can be said entirely to withstand it. It is true there is a great difference in the liability of different varieties to infection. Certain races of cane seem to become so impregnated with disease that it is hard to get any of them free from it, while others have so little that a careful search is necessary to find cases. But, even in the latter kinds, unless all diseased sets are weeded out at planting time, the number increases year by year and may become considerable. Sometimes, too, it happens that a bad season so weakens the constitution of a variety, or so increases the number of spores, that cases o infection through wounds become numerous, and the succeeding crop will have to be very carefully handled to avoid an epidemic. The examination of sets is an insurance against disease, and even if wasted for several years, is a precaution that cannot be neglected without probability of disaster.

The attacks of red rot are very insidious. An instance of this may be given from my own experience. A race of cane known to be very generally infected was grown on a large estate. In spite of its general failure elsewhere, it gave for some years good crops, and no danger was anticipated. In 1905 the fungus must have accumulated considerably and conditions then became favourable for its action. As a result, the very large acreage under this variety gave scarcely

twenty per cent. of a full yield. The loss was thousands of pounds and might have been avoided if the presence of the disease had been detected by inspection of the sets. Mr. Barber has described, in the account of the Samalkota Sugar Cane Farm, contributed to the first number of the *Agricultural Journal of India* (Vol. I, page 45), how successive canes have held favour in the Godaveri Delta during the past forty years, each in turn growing luxuriantly and bringing wealth, but after a few years becoming diseased and causing wide-spread loss. As a result of bad cultivation and neglect of seed selection, each cane variety in turn became thoroughly infected and had to be abandoned.

In seed for cane-planting the first point to be considered is the selection of the variety. In this the past history of the cane must be taken into consideration. I have already given an instance to show how dangerous it is to grow a variety from stock known to have been seriously infected, even though the crop may be promising for the first few years. Only seed from a variety which is known to be practically free from disease, and to have been so for some years, should be selected. On large estates it is unquestionably best to be self-contained in the matter of seed supply. When starting a new plantation or in small estates, this is often not possible, and seed must be obtained from outside. If this is necessary on a large scale, care should be taken to select a locality as similar as possible, as regards soil and climatic conditions, to that where the cane is to be grown. Sugar cane appears to be particularly susceptible to change of conditions, and the introduction of large quantities of seed from a locality with a different climate and soil is liable to lead to deterioration, at any rate temporarily. This does not affect nursery cultivation. There is no possible objection to the introduction of new varieties on a small scale, in fact it is highly advisable to do so wherever feasible, and the maintenance of a nursery for the experimental cultivation of promising varieties is strongly to be recommended. The best of attention should be given to the nursery crop, and as soon as a variety has been tested and found satisfactory, it can be increased on a field scale, a succession of healthy seed being thus brought forward into cultivation. In introducing new varieties from abroad, it should be remembered that several of the cane diseases of other countries do not occur in India, and nursery cultivation on a small scale is absolutely imperative in this case, so as to allow of the prompt destruction of any variety which shows signs of disease.

In harvesting the seed cane much trouble in the later part of the operations can be saved by leaving out all diseased plants or patches. Some disease is almost sure to be found at harvest time, so undesirable looking canes should be left behind. This will, undoubtedly, save time and expense later on. Rejected plants may be crushed if they

are worth it or, if not, they should be collected and burnt. They should on no account be left standing or ploughed in, as old dried-up canes often contain large quantities of the fungus which is capable of remaining alive in them for many months.

Where disease is prevalent, it is probably better to plant tops than cuttings from the whole cane. From the ordinary plantation point of view, indeed, the opinion is held in many cane-growing countries that tops give the best crops. With this I am not so much concerned here as with the question of the relative freedom from disease of tops as compared with whole cane cuttings. It is well known that the top part of the cane is poorest in sugar, and it is also better protected by the leaf sheaths, which comparatively cover the upper joints. It is, therefore, at least probable that these upper joints are less commonly attacked with red rot, and, though no comparative experiments have yet been carried out to determine this point, the probabilities are that, from the disease point of view, the tops furnish the best seed.

The general practice in India is, however, to plant cuttings obtained from the whole cane. These are cut into lengths containing, usually, three joints. The preparation of these should be entrusted to experienced men, as it is important for several reasons that the ends should be clean cut and not shattered. In inspecting the cuttings, the ends are the points chiefly requiring examination, and this is much easier with a clean cut surface than with a jagged one. Besides, it is very important that the part left between the end joint and the cut should be undamaged as far as possible. This is the weak point of the cutting, and the road through which not alone several parasitic fungi, but also white ants, attack the cane. If not clean cut, rotting sets in and, if the shattering at the end be considerable, will reach the bud before it has become independent of the set, and cause its death. Hence it is very important that the cutters should be experienced at their work.

The cut sets at Pusa are collected by boys into bundles of ten or fifteen sets, which are then inspected at the cut ends before being placed in baskets to carry on to the field. In the inspection the main point to be examined is the presence of any suspicious discolouration of the pith. Any sign of reddening of the fibres should be taken as an indication of the possible existence of red rot. In most cases cultures made from the pith of sets showing reddened fibres at the ends give a growth of the red rot fungus. Sometimes other parasitic fungi are concerned, and also insects. But in any case it is necessary to reject all cuttings with reddening at the ends. Borer holes should also be looked for, as bored sets sometimes contain the fungus in the immediate neighbourhood of the hole, while apparently healthy at the ends.

The inspection of the sets can be carried out by any reliable overseer with very little practice. There has never been any difficulty at Pusa

in training men to do it well. Even the cutters themselves, after a time, become fairly careful in rejecting any cutting which shows signs of injury. The result has been that at Pusa we have not had any general disease, except in the case of the variety *yerra* previously mentioned, and the death of whole clumps has been very rare in the varieties grown, some twenty-five in number. This has been the case although the last two seasons have been, undoubtedly, very favourable for the attacks of the parasite, owing to the monsoon floods. This year there was a large number of single cane infections above the ground, but at harvest time it was found that these did not affect whole clumps and were clearly cases of new infections, probably through wounds, and there is no reason to anticipate any difficulty in keeping the new crop healthy. We have succeeded up to date in preventing the epidemic form of the disease, which results in the loss of whole clumps, while being unable to check the cases of new infection of individual canes. The disease appears to be under such control that in good seasons we may expect little or none, and even in bad seasons, such as last year, we should not have any general destruction of the crop.

FRANCE.

Results of the Campaign of 1906-07.

The results of the French sugar campaign of 1906-07 have just been issued. The number of factories in operation has been 273 as compared with 292 during the preceding campaign, a decrease of no less than 19. In 1883-84 483 factories were at work.

The area under beet cultivation is unofficially estimated at 200,064 hectares as compared with 276,331 hectares in 1905-06, and 191,160 hectares in 1904-05. The decrease amounts to 27 per cent.

The production of sugar expressed in refined amounted to 682,851 metric tons against 984,672 metric tons in 1905-06, a decrease of 301,820 tons or 30 per cent. This deficit is mostly accounted for by the reduction in the sowings of 27 per cent., and a lower yield to the hectare (27·2 metric tons as compared with 30·4 tons). The yield in sugar per cent. of beets was 12·52%, an increase of 0·82%.

The consumption of refined sugar during 1906-07 amounted to 574,803 metric tons, as compared with 583,550 tons in 1905-06.

The stocks available on August 31st last were 325,821 metric tons as compared with 417,237 tons in 1905-06.

THE SUGAR INDUSTRY IN NEW SOUTH WALES.

The Melbourne *Journal of Commerce* has published some interesting particulars which have been compiled officially relating to sugar cultivation in New South Wales in respect to the season closed on 31st March last; together with an estimate for 1907-8. Our contemporary has added particulars for 1903 and 1904:—

	Growers Employing Labour. White.	Black.	Total.	Area. White.	Acres. Black.	Total.
1903-4	1,222	178	1,400	22,076	2,503	24,579
1904-5	1,304	222	1,526	19,114	2,411	21,525
1905-6	1,405	122	1,527	19,612	2,193	21,805
1906-7	1,387	192	1,579	18,645	1,956	20,601
1907-8	1,263	169	1,432	16,213	1,890	18,103

The percentage of area cultivated by white labour in 1903-4 was 89·81 and rose to 90 in 1905-6. Last season it was 90½, and it is estimated that in the coming season it will be 89·65, absolutely less than when there was no bounty.

	Cane Produced by White. Tons.	Black. Tons.	Total. Tons.	Sugar Produced by White. Tons.	Black. Tons.	Total. Tons.
1903-4	200,847	26,664	227,511	19,236	2,561	21,797
1904-5	180,535	19,105	199,640	17,812	1,838	19,650
1905-6	181,170	20,828	201,998	18,019	1,964	19,983
1906-7	205,896	15,663	221,560	21,805	1,613	23,418
1907-8	241,000	13,350	254,350	24,100	1,335	25,435

The bounties paid were 1903-4, £40,154; 1904-5, £36,107; 1905-6, £36,234; and 1906-7, £42,789, while in the coming season it is estimated to be £72,300. Thus, since the Sugar Bounty Act has been in force the enormous sum of £263,917 will have been paid, with the result that the area cultivated will have fallen from 24,057 acres in 1902-3 to 18,103, a shrinkage of more than one-fourth. An excuse is offered that the wet weather has, this season, damaged the ratoons; the reduction in the area cultivated being also affected by dairying proving more attractive, even to bounty-fed growers. But the shrinkage in area has been proportionately greater in white than in black-grown sugar, the decrease in white being 26½% and in black 24½%. It is true that the total quantity of sugar and of that grown by white labour has increased, but the seasons have had most to do with that. The only correct way to appraise an improvement in the industry is to adopt the area under cultivation as a basis.

A HAWAII IRRIGATING CANAL.

Some details are given in a recent number of the *Hawaiian Planters' Monthly* of a new canal which is being constructed to bring the water of the Waimea river on to the cane lands of the Kekaha Sugar Company of Kauai. Preliminary surveys were made in August, 1905, and by the middle of last July the work was completed.

The Waimea river is one of the largest streams in the islands; it has a dry-weather flow of nearly 100 million gallons a day, which until recently ran to waste in the sea. A mile from the shore it divides into two branches of about equal size—the Olokele and the Waimea proper.

The Kekaha-Waimea canal has its intake on the latter branch eight miles up from the sea at an elevation of 550 feet. The intake is by means of a tunnel which enters a deep pool below the surface, and the water is admitted through two grated openings, each 5 feet by 6 feet. Passing through a series of tunnels inside vertical palis 600 feet high, then by cutting through fields of rocks of great size, or by a raised ditch fitting on to the ground, the water is led for four and a half miles to the edge of a plateau above the river. At this point it crosses the Waimea valley by means of an inverted syphon of steel pipe of 48 to 42 inches diameter and 2190 feet long, and delivers into tunnels 50 feet above the Waimea flume.

Emerging from here the canal traverses gently sloping ground, then passes through tunnels, gulches, and two more syphons, till it finally reaches its destination.

The tunnels are 8 feet wide and 6 feet high. They have an aggregate length of 8,660 feet and they were driven for the most part through very hard rock. The canal has a capacity of 55,000,000 gallons per day above the syphon across the Waimea Valley and 45,000,000 gallons below, the size of the latter being 8 feet wide at the bottom and 4 feet 3 inches deep. The surplus water is turned back into the river from the syphon but could be arranged to yield some 750 horse-power to turbines fitted at the spot. No flumes are used except for a few gulch crossings.

At Waiawa the water is dropped 280 feet to a lower ditch nine miles long that will convey it to the end of the plantation. This 280 feet drop will probably be utilized for generating electric power for the plantation.

About 600 labourers were employed on the construction of this canal, of whom a good number were regular plantation hands of the Kekaha Sugar Company.

MEXICO'S SUGAR INDUSTRY.

Some details are given in a recent number of the *Financier* of the sugar industry existing in Mexico. This country does not at present produce an appreciable quantity of the world's supply of sugar; but like Cuba her possibilities of sugar production are so great that it only requires time and enterprise to make her one of the leading cane sugar countries in the world.

The cultivation of sugar in Mexico is said to have been introduced immediately after the conquest by Cortes, and the sugar thus produced was exported to Spain and Peru. But in 1905-06 the total Mexican sugar production was only some 107,000 tons, the whole of which was consumed within the country, while Peru's output for the same year was 150,000 tons.

The climate and soil are favourable to sugar cultivation—in some places specially so—and it is solely due to the primitive modes of manufacture which have been in vogue till just lately, the difficulty of obtaining labour, and the high cost of transport, which have prevented the expansion of the industry and the exportation of the large surplus which such expansion would have produced. Now, however, modern mills are being introduced, and the Government recently placed an import tax on foreign sugar to the extent of 1¼d. per lb., which further stimulated the production. The output for the last eight years has been as follows:—

	Tons.		Tons.
1899-1900	75,000	1903-4	107,000
1900-1	95,000	1904-5	107,000
1901-2	103,000	1905-6	107,500
1902-3	112,000	1906-7	115,000

The old plantations are installing new machinery, and land is being taken up extensively for new plantations. Practically all the estates are owned by Mexicans, who employ Spanish administrators to quite a surprising extent; several American companies are, however, starting operations in the state of Vera Crux.

The canes, especially in the Gulf States, grow well and will ratoon for eight or nine years. But the best returns are given by the irrigated lands in the state of Morelos where the saccharine content of the juice is the highest. The average crop of cane is from 40 to 45 tons per acre, though in some exceptionally favourable localities as much as 60 tons is obtained. In the irrigated lands the cane is re-planted every third year. The canes are cut from December to June.

Most of the new machinery in use in Mexican mills comes from the United States, and the reasons given for this fact are the quickness of delivery of American firms as well as the special facilities such firms offer to planters installing their machinery. Some British houses are, however, getting a footing, and there is no doubt that when the quality of their goods gets better known, they will secure a larger share of the trade.

CONSULAR REPORTS.

Persia.

Resht and Astarabad.—Sugar is the principal import from Russia, and upwards of £500,000 worth of this commodity passed through the Ghilan customs in the year 1905-06. The greater part of this sugar is forwarded to Tehran, the principal sugar market in Northern Persia.

Through the closing of the Caucasus to the transit of all foreign goods, and through the system of bounties, Russian sugar has completely ousted French sugar from the markets of Northern and Central Persia. Some 25 years ago Marseilles supplied practically the whole of Persia by the Caucasus, Trebizond and Bushire routes.

Morocco.

Tangier.—The United Kingdom, whilst sending all the crushed and some of the cut sugar, has no share in the loaf sugar trade which is principally in the hands of France, though the Austro-Hungarian and Belgian refineries have succeeded in placing considerable quantities on the market, sugar from both these countries being shipped from German ports. Some cut and loaf sugar comes from Germany. The amounts of loaf and cut sugar imported in 1906 have been as follows: 12,178 cwts. from France, 7,500 cwts. from Austria-Hungary, 6,796 cwts. from Belgium, 2,233 cwts. from Germany, 193 cwts. from United Kingdom.

Surinam.

Older sugar canes suffered somewhat from the drought during the latter part of the year 1906 in some places, and now (in May, 1907) the plantations are suffering from the abnormally wet season.

The total product last season was 12,635 tons (of 1,000 kilos.) first and second product, 180,066 gallons rum and 417,184 gallons molasses, against 10,790 tons sugar, 174,451 gallons rum, and 345,348 gallons molasses in the previous year.

China.

Swatow.—Of sugar, the staple export product of this district, the export was 387,632 cwts. brown, and 275,278 cwts. white, as compared with 586,895 cwts. brown, and 370,721 cwts. white, during the previous year. In piculs the total export this year was 556,845 piculs. The annual production was formerly 1,400,000 to 1,500,000 piculs, and Swatow sugar supplied almost all the markets in the Yangtse and North China ports, but now refined sugar from Hong-kong and from Japan, and imports of Java sugar from Hong-kong are gradually supplanting the local product. During 1906 there was a phenomenal fall in the prices of raw and refined sugar all over the East of from three to four dollars per picul; the prospects therefore of

the Swatow industry for 1907 are by no means encouraging for growers.

Owing to the gradual decay of the sugar industry of late years much land has gone out of cultivation. With a view to the re-organisation of the local sugar industry and restoration to its former prosperity, deputies from the Bureau of Trade at Canton have recently visited the port to investigate the local conditions, and for their information the local Chamber of Commerce was called on to furnish a report on the subject. The following details, extracted from this report as published in one of the native newspapers recently, may be of interest:—

The area in this district now under sugar cultivation is estimated at about 150,000 mou or say 22,500 acres in all, the native sugar crushing mills numbering about 2,000. These work on the average 100 days in the year, each establishment turning out from 600 to 1,000 piculs or about 700 to 1,200 cwts. of sugar. Each mill employs some 25 hands at wages of 350 cash per man per diem, the hours of labour being from 5 a.m. to 9 p.m. In the Cheng-hai district the sugar cane is purchased from the cultivators by the mill owners, but in the Chao-Chow and other districts, where the cultivation is more scattered, a mill is set up by the nearest villagers and hired out in turn at so much per day. Each mou of land will produce about 700 catties of sugar, about 55 bunches of canes being required to produce 100 catties of juice. White sugar now fetches from 7 dollars to 8 dollars 80 cents per picul, according to quality; that locally known as foreign sugar, which is slightly inferior to the white, costing 6 dollars to 6 dollars 50 cents per picul, and so-called "Ching-Tang" about 5 dollars per picul. Two years ago the produce in sugar cane of one mou of land fetched 38 to 39 dollars, whilst this winter and spring the value of the cane was not more than 21 to 22 dollars per mou, each mou of land producing about 700 catties of sugar.

As regards mode of cultivation, the land is planted once a year, during the first, second or third months, the cane maturing in about 10 months. Each mou of land is planted with 1,100 or 1,200 bunches of cane in rows about one foot apart, each bunch consisting of five to nine stalks of cane. In the first year the crop is raised from cuttings which are steeped in water for three days and then covered over with sand or straw and watered once a day. In the second and third years the crop is ratooned. In the fourth year the roots are stubbed up, and the land is planted with some other crop. The fertiliser almost exclusively used is bean cane, the cost of which is about seven taels per mou for good level ground, but nine taels for poor and hilly land.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Application.

19099. C. P. Stewart, London. *Process for making sugar.* (Complete specification.) 24th August, 1907.

Abridgment.

22387. The Mirrlees Watson Company, Limited, Glasgow, Scotland. (Communicated by E. C. Knight, Tucuman, Argentine Republic.) *A process for removing the impurities from cane juice and apparatus connected therewith.* 10th October, 1906. This invention relates to a process for removing impurities from cane juice the combination of heaters so arranged as to raise the temperature of the cane juice between 200° and 260° Fahr., with a suitable separator to separate the vapours from the juice and delivering the latter into a mixing tank or partly to filter presses and partly to the mixing tank, with a temperature maintained at about 212° Fahr., the juice being agitated by suitable mechanical means and suitable connections and cocks from the separator, mixer, and pump.

GERMAN.—Abridgments.

186684. Wilhelm Hasse, of Halle-on-Saale. *A device for discharging centrifugals more particularly for the sugar industry.* 28th August, 1906. (Patent of addition to Patent No. 185651, of 4th March, 1906.) This is an improvement on the discharging device described in the original Patent No. 185651 and consists of chambers located permanently in the centrifugal or inserted from the outside, in which after the completion of the centrifugalling operation the chambers may be set in motion in the centrifugal in a suitable direction by hand or mechanical means, by means of a driving gear independent of that of the centrifugal and whether the centrifugal be stationary or rotating.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM)

To end of September, 1906 and 1907.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1906. Cwts.	1907. Cwts.	1906. £	1907. £
Germany	6,640,692	5,905,123	2,854,695	2,820,199
Holland	88,999	338,078	37,356	172,605
Belgium	754,969	260,111	333,178	112,638
France	229,048	384,481	99,647	197,407
Austria-Hungary	178,019	298,756	72,627	135,043
Java	251,399	555,834	118,372	294,412
Philippine Islands	....	187,693	....	77,287
Cuba	111,885	91,113	41,943	39,610
Peru	471,109	436,200	212,078	215,041
Brazil	957,934	189,908	375,649	78,405
Argentine Republic	....	....	....	....
Mauritius	126,741	491,422	48,362	200,532
British East Indies	88,267	118,274	34,351	50,509
Straits Settlements	69,616	162,764	28,084	66,735
Br. W. Indies, Guiana, &c.	1,461,945	1,104,923	774,661	635,558
Other Countries	186,350	506,108	86,559	249,097
Total Raw Sugars	11,616,973	11,020,788	5,117,562	5,345,078
Refined Sugars.				
Germany	9,284,574	10,180,499	5,288,267	6,021,678
Holland	2,085,756	1,905,853	1,256,827	1,212,426
Belgium	309,341	312,422	179,913	190,867
France	2,070,401	2,823,139	1,168,821	1,653,929
Other Countries	797	2,662	476	1,844
Total Refined Sugars	13,750,869	15,224,575	7,894,304	9,080,744
Molasses	2,119,578	2,132,566	402,640	421,453
Total Imports	27,487,420	28,377,929	13,414,506	14,847,275

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden	128	292	115	220
Norway	13,929	11,011	8,286	6,741
Denmark	78,578	74,443	39,500	40,728
Holland	59,161	50,704	35,851	34,272
Belgium	8,488	7,085	4,879	4,354
Portugal, Azores, &c.	23,551	14,286	12,771	8,026
Italy	29,824	20,107	15,066	10,948
Other Countries	509,253	371,429	329,196	276,331
	722,912	549,357	445,664	381,620
Foreign & Colonial Sugars				
Refined and Candy	29,911	29,267	18,624	19,534
Unrefined	153,470	62,046	78,254	37,015
Molasses	5,490	4,138	1,761	1,247
Total Exports	911,783	644,808	544,303	439,416

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1907. Tons.		1906. Tons.
Total Receipts Jan. 1st to October 17th..	1,665,999	..	1,647,858
Receipts of Refined ,, ,, ...	670	..	1,705
Deliveries ,, ,, ...	1,655,872	..	1,691,543
Consumption (4 Ports, Exports deducted) since January 1st..	1,579,135	..	1,649,900
Importers' Stocks, October 16th	10,127	..	14,848
Total Stocks, October 30th	212,000	..	144,050
Stocks in Cuba, ,, ...	39,000	..	13,000
	1906.		1905.
Total Consumption for twelve months..	2,864,013	..	2,632,216

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1906 AND 1907.

(Tons of 2,240lbs.)	1906. Tons.		1907. Tons.
Exports	1,110,685	..	1,316,309
Stocks	36,429	..	63,045
	1,147,114	..	1,379,354
Local Consumption (nine months)	32,570	..	34,980
	1,179,684	..	1,414,334
Stock on 1st January (old crop)	19,450	..	—
Receipts at Ports to 30th September ..	1,160,234	..	1,414,334

Havana, September 30th, 1907. J. GUMA.—F. MEJER.

UNITED KINGDOM.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION FOR NINE MONTHS ENDING SEPTEMBER 30TH, 1907.

SUGAR.	Imports. 1905. Tons.	1906. Tons.	1907. Tons.	Exports (Foreign). 1905. Tons.	1906. Tons.	1907. Tons.
Refined	520,213	687,543	761,229	966	1,496	1,463
Raw	500,924	580,849	551,039	3,672	7,673	3,102
Molasses	93,705	105,979	106,628	137	274	207
Total..........	1,114,842	1,374,371	1,418,896	4,775	9,443	4,772

	Home Consumption. 1905. Tons.	1906. Tons.	1907. Tons.
Refined..	525,117	663,534	742,602
Refined (in Bond) in the United Kingdom	406,021	414,435	375,778
Raw	79,365	92,979	91,248
Molasses	86,238	97,645	95,691
Molasses, manufactured (in Bond) in U.K.	39,025	44,263	46,069
Total..................................	1,135,766	1,312,856	1,351,388
Less Exports of British Refined......................	20,615	36,145	27,468
Total Home Consumption of Sugar	1,115,151	1,276,711	1,323,920

Stocks of Sugar in Europe at uneven dates, Oct. 1st to 26th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1907.
144	96	248	108	29	624

	1906.	1905.	1904.	1903.
Totals	728 ..	597 ..	775 ..	1177

Twelve Months' Consumption of Sugar in Europe for Three Years, ending September 30th, in thousands of tons.

(Licht's Circular.)

Great Britain.	Germany.	France.	Austria-Hungary	Holland, Belgium, &c.	Total 1906-07.	Total 1905-06.	Total 1904-05.
1877	1138	646	517	200	4379	4517	3685

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1907-1908. Tons.	1906-1907. Tons.	1905-1906. Tons.	1904-1905. Tons.
Germany	2,225,000 ..	2,238,000 ..	2,415,136 ..	1,598,164
Austria	1,375,000 ..	1,344,000 ..	1,509,870 ..	889,373
France	825,000 ..	756,000 ..	1,089,684 ..	622,422
Russia	1,300,000 ..	1,470,000 ..	968,000 ..	953,626
Belgium	250,000 ..	283,000 ..	328,770 ..	176,466
Holland	175,000 ..	181,000 ..	207,189 ..	136,551
Other Countries .	430,000 ..	445,000 ..	415,000 ..	332,098
	6,580,000	6,717,000	6,933,649	4,708,758

THE

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☞ All communications to be addressed to the Editor, Office of "The Sugar Cane," Altrincham, near Manchester.

All Advertisements to be sent direct.

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The Editor will be glad to consider any MSS. sent to him for insertion in this Journal and will endeavour to return the same if unsuitable; but he cannot undertake to be responsible for them unless a stamped addressed envelope is included.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

NOTICE TO READERS.—If the Advertisement pages stick together, bang their edges on the table, when they should easily separate.

NOTES AND COMMENTS.

Mr. Algernon E. Aspinall.

Mr. Algernon E. Aspinall, Secretary of the West India Committee, was the honoured guest of the West Indian Club at a dinner held on November 1st last, to mark the occasion of his recent marriage. A very large and representative gathering of West Indians assembled, and before the proceedings terminated he was presented on behalf of various bodies with some interesting and valuable presents. The Executive of the West India Committee presented him with a handsome silver tray and tea and coffee service; the Grenada Agricultural and Commercial Society sent two massive silver candlesticks "in recognition of his untiring energy in furthering the interests of the colony"; the British Guiana Planters' Association sent a loving cup and a cheque, while friends in Trinidad chose him a large silver cigar and cigarette box. These remembrances must have been very gratifying to the recipient, and will certainly encourage him to persevere in the good work in which he has been engaged for some years past. For ourselves, we cannot conclude this note without congratulating Mr. Aspinall and expressing the hope that he may long be spared to occupy his place at the helm of the West India Committee, to the great benefit of all those who come under its influence in one way or other.

The Lull in Sugar affairs.

Things have been very quiet the last few months in the industrial and political world of sugar at home. The first eight months of the year were full of the strife of parties and the scheming of capitalists. The approaching renewal of the Sugar Convention, the renewed attempt to get the sugar tax repealed, and the assiduous plans to start a beet sugar industry in the eastern counties absorbed the attention of interested parties and provided the newspapers with many a column of copy. The results are now a matter of history; the sugar tax was retained for another year at least in spite of the strong opposition shown by members of the Government party in the House of Commons, the beet-growing schemes just when they seemed to be ripe for elaboration had to be abandoned owing to the unfriendly attitude of a free-trade Government, and finally the thorny question of the Brussels Convention instead of being brought to a head in August was shelved for a few months at least by painstaking diplomacy which evolved a new policy for enabling the British Government to remain a member of the compact. Elsewhere in this number will be found the pith of the Official Correspondence relating to this work of the International Commission, which will be read with interest by those of our readers who have followed without interruption the history of the negotiations leading up to the Brussels Convention as well as following on its completion. Since August however there has been a period of quiet if uncertain suspense. As we show in our article on "The Fate of the Brussels Convention," appearing on another page, success or failure now rests on the decision of Russia, and we must look to her to help us out of the mess in which our Government has landed us. Germany's continued adherence to the Convention depends very largely on what Russia decides to do; and if Russia comes to the conclusion that her interests are best served by remaining aloof from any international compact, the position will become a very awkward one. The Brussels International Commission met about the middle of last month and at the time of writing the result of their deliberations has still to be announced. It is known however that Russian delegates were present and that the chief proposal under consideration was the devising of a scheme by which Russian sugar could be given the benefit of the Convention. The general impression is that this would be on the basis of limiting the exports of Russian sugar. As to the wisdom of this plan we have something to say on another page. It is at best an attempt to cure an evil instead of devising measures to prevent it.

England, however, has robbed Russia of the chief inducement to come into line with the others. And England so far is blissfully ignorant of what she has done. Her press has not, of late, devoted any adequate space to the subject, and its correspondence columns

have not shown any inclination to dwell on the matter. Save for one solitary letter in the *Times* from a political Ishmael, and one or two others in the intellectual weeklies, the papers have been barren of information. Perhaps, on the whole, not unwisely, for if just now we badly want some sane counsels, we want, even less, ill-advised not to say fanatical outbursts, such as filled the columns of the Liberal papers at the beginning of the year. But this lull may not last long; Brussels will have to come to a decision, and if it is unfavourable we may have all our labour over again. Our Government may be left with the choice of plunging further into the slough or of retracing their steps as best they can and abandoning the untenable position they secured under the terms of the Additional Act. That they will withdraw from the Convention itself is hard to believe; even the sugar users, whatever they may say in public, do not among themselves view with equanimity the prospect of their goods being shut out of Continental countries by means of prohibitive countervailing duties—an eventuality which is certain to follow the break up of the Convention.

Seedling Canes in Louisiana.

According to an American exchange, Professor R. E. Blouin has officially announced that it has at length been found possible to raise sugar cane in Louisiana from seed. He says:—"Since the introduction of seedling canes, such as D 74 and D 95, both of which have proved in their fourteen years of trial in Louisiana superior to home cane, an effort has been made to germinate seed of sugar cane in Louisiana with the hope of acclimatising the seedlings with more readiness and permanency than those imported from seedlings germinated in the tropics. By seedlings we mean those produced from seed formed in the tassel or arrow of cane. Every effort prior to 1906 to germinate these seeds (which were secured from the tropics) was a failure. In 1906, by carefully husbanding the cane through attentive work at the Audubon Experiment Station, cane seeds were first germinated, and twenty-eight plants were secured, of which only four survived. These have been planted as the first Louisiana seedlings. Following this, and steadily gaining more experience with the seedlings, this year we succeeded in the generation of something over 200 plants, of which nearly 100 are now planted as the second season Louisiana seedlings, a number of which give good promise of economical results. The growing season in Louisiana for sugar cane is normally too short to produce the tassel or seed, though in rare instances a few stalks have been known to produce tassels which formed only immature seed."

French Sugar Factory Statistics.

In the "Results of the Campaign of 1906-07 in France" which appeared in our last issue, the number of factories at work (273) was

compared with the figure of 1883-84 when 483 was the number. It has been pointed out to us that this statement standing by itself might give rise to the impression that there had been a corresponding decrease in production. This has obviously not been the case, and it is of interest to note that not only in France but in Germany as well there has been of late years a tendency to shut up certain small factories and concentrate the work at a few large ones. Thus Germany has closed more than 24 factories within four years. This plan has been rendered all the more advisable since the Brussels Convention reduced the price of sugar for consumption, and consequently also the manufacturing profits. But there has been no reduction in the total output apart from differences of single years. On the contrary there has been a steady increase when five or ten year periods have been taken for comparison. And doubtless the coming application of beets to the manufacture of industrial alcohol will still further stimulate production.

Mexico's Sugar Industry.

In the article on Mexico's Sugar Industry which appeared in our November issue (page 570) and which was taken from a longer notice in the *Financier*, the statement in the last paragraph that most of the Mexican mills came from the United States was, we find, not altogether accurate, as apart from the factories founded with American capital the greater number of the mills erected within the last few years have been, if we are rightly informed, supplied by Glasgow firms, amongst whom the Mirrlees Watson Company have taken the principal share. This firm have lately shipped a new plant required for the Ingenio "Treinta" and have now an order on hand for the new Ingenio "Chinameca" belonging to Sr. Don Vicente Alonso.

The German monopoly of orders for Java sugar factories seems much less pronounced now-a-days than was once the case. The Java estates are now more inclined to try other than Continental machinery, and British as well as American manufacturers have been competing for recent orders. One such order was lately secured by a Glasgow firm (The Mirrlees Watson Company) and comprises a 12-roller mill with Krajewski crushers. It will be one of the most powerful cane crushing plants ever built.

That the French sugar industry does not show the same tendency to expand as does that of its neighbours, Germany and Austria, is undoubtedly due to the fact that agricultural labour and freight charges in France have long been much higher than those ruling in the other two countries, while the production of sugar per hectare is lower.

THE FATE OF THE NEW SUGAR CONVENTION.

We said last month that Russia and other sugar producing States had been deprived, by the British Government, of any inducement to join the Convention. Confirmation of that opinion came quickly. We quote the following from the *Journal des Fabricants de Sucre* of the 20th November :—

According to the *Berliner Tageblatt*, the Russian Minister of Finance, Kokowzow, has made the following declaration :—

"The Ministries of Finance and Commerce have sent a delegate to Brussels. Russia, now that England has separated herself from the Brussels Convention, has no great interest in adhering to that agreement. We are naturally quite disposed to enter into it if it can be done under satisfactory conditions. But we shall never allow ourselves to be led to attain that object at any price. We have no desire to export sugar to neighbouring Western countries, because those countries are already sufficiently supplied by their own production. As to exportation to Finland and Persia, it is certain that no other State can compete with us in those markets.

"We are in the position of a stipulator who can wait calmly, examine without haste the proposals, and accept the offers if they appear to be worth having. Russia can organize her sugar trade in a profitable way with or without the Brussels Convention."

This tallies exactly with the views we have repeatedly urged. We shall see presently whether the "offers" turn out to be "worth having."

The Austrian sugar industry has at last spoken out, so we now have the views of all the three States who contribute the bulk of the Continental sugar production. The Society of Austrian Sugar Manufacturers have addressed to the Minister of Finance a petition, dated the 8th November, in which they state their views with regard to the Convention as modified in accordance with the desire of England. They say that in consequence of the suppression of the penal clause in the markets of Great Britain the Convention has lost a great part of its value; but, nevertheless, it would be possible to increase that value if Russia would consent to enter into the agreement on terms acceptable by the other States; namely, such a revision of the Russian fiscal and customs system as would bring it into conformity with the conditions in force in the other contracting States; reduction of the customs surtax to 6 fr. per 100 k., or the raising of the surtax in the contracting countries to the level adopted by Russia. In default of this arrangement there must be a limitation of Russian exportation to the figure of the last few years, or at least to that of a few years preceding the Convention. But the problem of such limitation appears difficult to resolve. Should Russia be

admitted into the Convention on privileged terms the result would be a great danger to the other contracting States, and especially to Austria; for Russia enjoys many advantages:—a low rate of wages; low rent of land; absence of heavy rates for social legislation; the stimulant given to beetroot production owing to the low price of cereals; increasing importance of the consumption, permitting the sugar industry to raise on the home markets the funds necessary to carry on the export trade and compete successfully with the foreigner. In the opinion of the Austrian sugar manufacturers, the surtax of 6 francs established in Austria is not sufficient to put her on an equality, and enable her to prevent the importation of Russian sugar. If, therefore, Russia is permitted to maintain her surtax at a rate above that of the other contracting States it would be necessary to permit the contracting States to have the power to levy a special surtax on the importation of Russian sugar equivalent to the difference between the two surtaxes.

The petition concludes by expressing regret that the sugar industry had not been consulted by the Government before the despatch of the Austrian delegates to the preliminary conference in Paris.

We have already given good and sufficient reasons why, in our opinion, Russia should be permitted to have a surtax in excess of the conventional surtax of 6 francs. As to any other modifications of her system we believe, as already explained in former articles, that no other modification would be necessary than the very simple one by which the stimulus to over-production would be practically removed. This we explained to consist in substituting for the present arrangement, by which the proportion which each factory is allowed to enjoy in furnishing the supply for home consumption is based on its largest production during the preceding eight years, a new and much simpler rule that the proportion enjoyed by each factory should be a fixed and permanent one. There would then be no inducement to a factory to increase production merely in order that in future the "contingent" of that factory should be increased. At present each factory struggles thus to get an increased "contingent," with the result that there is a general increase of production all round much in excess of the natural increase of consumption, and, therefore, with the result of creating a surplus stock very difficult to deal with.

This simple reform is what the Permanent Commission at Brussels ought to press on the serious consideration of the Russian Government. It is reasonable, it does not meddle with the general system adopted with so much success by Russia, and it is really in the true interest of the Russian sugar industry. This one slight reform, coupled with a modified surtax, ought to be sufficient to please everybody. But, as the Russian Minister of Finance truly says, "Russia can organize her sugar trade in a profitable way, with or without the Brussels Convention."

The scheme which seems to be commending itself to the negotiators at Brussels is a simple demand that Russia should limit her exports. It does not seem to occur to any of the delegates or any of their Governments that this is impossible under present conditions. In order to limit exports Russia must limit production. But under her present system she stimulates production. To limit, and at the same time artificially to stimulate production, is impossible. Therefore the stimulus is the thing to be attacked by the negotiators, not the effects of the stimulus; it is the disease which must be cured, the symptoms cannot even be alleviated.

The "Correspondence respecting the Additional Act to the Brussels Sugar Convention" gives us one or two interesting indications of the views of the Contracting Parties. The pith of the Additional Act is thus given in the official translation of Article II.

"Notwithstanding [in derogation of] Article I., Great Britain will be relieved, after the 1st September, 1908, from the obligation contained in Article IV. of the Convention.

"After the same date the contracting States may demand that, in order to enjoy the benefit of the Convention, sugar refined in the United Kingdom and thence exported to their territories shall be accompanied by a certificate stating that none of this sugar comes from a country recognized by the Permanent Commission as granting bounties for *(sic.)* the production or exportation of sugar."

This is the concession made to Great Britain by the other contracting States, and the counter concession made by her to them. The one deprives all the contracting States of the security, given to them at Brussels in 1902, that if they would abolish their bounties they should never have to compete in British markets with sugar receiving a bounty. They abolished their bounties on the faith of that security. Without it they cannot have free trade on British markets.

Nevertheless they have signed their "Act" which deprives them of it, and in return what have we given them? We do not undertake that all refined sugar exported from Great Britain shall be accompanied by a certificate that it is not made from bounty-fed sugar, but merely that refined sugar "*exported to their territories*" shall be so certified.

This of course is a pure farce, because the Contracting States make a great deal more refined sugar than they consume, and are, therefore, exporters, not importers of that commodity. Moreover they are protected by a surtax which they themselves admit to be quite sufficient to keep out all foreign competition in their markets. Thirdly, our exports of refined sugar are a mere trifle as compared with the production or consumption of the great European countries. The delegates at the Brussels Commission must have smiled when this second clause in Article II. was drafted.

The Belgian Minister in London communicated the draft Additional Act to Sir Edward Grey on the 1st August. On the 17th of the same month he informs Sir Edward Grey that, with the exception of Germany, Italy and the Netherlands, all the contracting States had assented to the draft Additional Act, and he enclosed the text of a Memorandum from the German Government of the 7th August; together with the note which the Belgian Government returned in reply.

The German Government, in their Memorandum, declare that they "are sincerely desirous of securing the continuance of the Brussels Sugar Convention, of the satisfactory results of which they are aware." But, "when, in consequence of the intervention of Great Britain, one of the most important fundamental provisions of the Convention was to undergo a radical alteration, those Germans whose interests were affected declared that it was difficult to reconcile the British proposals with the interests of our own industry." In the opinion of the German Government "the attitude of Russia towards the Brussels Convention is of very great, if not final, importance," and they therefore desire "that the Imperial Government may be informed as soon as possible as to the eventual adhesion of Russia." They add that if Russia were inclined to adhere in principle to the Convention without being able to accept, without alteration, all its stipulations, "it would not be possible to avoid holding a Conference . . . . to consider the question of the adhesion of Russia; this Conference could also examine the proposals made by the Permanent Commission at Brussels."

These are the salient points in a rather long memorandum. The memorandum of the Belgian Government in reply is even longer. It is explained that the signature of the Additional Act before the 1st September is with the object of preventing the denunciation of the Convention by the British Government on that date; but that the Governments would "only consider themselves definitely bound when they had ratified the arrangement." It would therefore be competent for the German Government to make the ratification contingent upon a favourable result from the renewed consultation to which they intend to have recourse. "For the rest, it seems that it would be advantageous to wait, before submitting to a diplomatic conference the question of the adhesion of Russia, until previous exchange of views between the allied Governments on the subject of the basis of negotiations shall have demonstrated the expediency of this meeting." A conditional adhesion "would testify to the general wish to prolong the international understanding, and would prevent the isolated denunciation of the British Government, which would probably produce in industrial circles an impression all the more marked because the deliberations of the Permanent Commission had given grounds to hope for an early agreement." If on the 1st February

there resulted a failure to agree there would be still sufficient time, before the 1st September, to submit to the Diplomatic Conference "the questions to be settled in view of the continuation of the Union."

On the 18th August the German Government explain that they are not yet in a position to know exactly to what extent the adoption of the proposal of the British Government will be likely to affect the interests of the German sugar industry. Their decision in regard to ratification must therefore "be made dependent upon the fact of Russia having adhered to the Brussels Sugar Convention at the proper time and on acceptable conditions."

We now know exactly the position at the time when the Permanent Commission met on the 18th November, except that we do not yet know what proposals Russia may have made for getting the British Government out of the trouble they have created for themselves. The cry is, Russia to the rescue.

The hopes and fears at Brussels are well represented in the following telegrams from Reuter's correspondent:—

"Brussels, November 26th.—The Permanent Sugar Commission, which was to have held two sittings to-day, met only this morning, as the Russian delegates are awaiting from their Government instructions necessary for carrying on the negotiations. A less reassuring feeling appears to prevail among the delegates concerning the present state of the latter. The concessions recently made to Russia had excited hope that an agreement would be reached. It appears, however, to some of the members that the Russian Government is not too well-disposed to adhere to the Brussels Convention. Should it fail to waive some of its claims, the latter may be definitely rejected by the Commission."

"Brussels, November 28th.—News regarding the negotiations which have been opened by the Permanent Sugar Commission continues to be most reassuring. The instructions transmitted to the Russian delegates have entirely altered the position of the negotiations, and have dispelled the fear arising from the apparent inertia of the Imperial Government. The Russian Government has made very substantial concessions which its delegates have communicated *en bloc* to the Commission, producing a most favourable impression. There naturally remain very important questions to be settled, but it now appears that an agreement may be reached, and, indeed, such is the almost unanimous opinion of the Commission."

The correspondent tells us on the 26th that "a less reassuring feeling appears to prevail," which seems hardly consistent with his saying, in his next message, that news "continues to be most reassuring."

WEST INDIAN CLUB DINNER TO SIR CHARLES LUCAS.

Sir Charles Lucas, till lately the head of the West Indian Department at the Colonial office, was entertained at dinner on November 20th, by the West Indian Club, on the occasion of his taking up the position of Chief of the Dominions Department. About a hundred gentlemen were present and a letter was read from Mr. J. Chamberlain expressing regret that his state of health prevented him from personally doing honour to the guest of the evening. After the banquet some interesting speeches were made, of which we give some account below.*

The Chairman, Sir Nevile Lubbock, in proposing their guest's health congratulated him on his recent appointment to be a K.C.M.G. He first made Sir Charles Lucas' acquaintance when the latter was Chairman of the Emigration Information Committee; all who served on that committee were impressed with the very earnest and painstaking manner in which Sir Charles had carried on the work. When he was removed to the West Indian Department, he at once showed great sympathy with those colonies and it had been a great pleasure to discuss matters with him. There were many occasions when he (Sir Nevile) had not agreed with Sir Charles' view, but he could say with truth that it was more pleasant to disagree with Sir Charles than to agree with him, for naturally when they disagreed the discussions were more prolonged. He congratulated the self-governing colonies on having obtained Sir Charles' services. Much would depend on the attitude of the Mother-country to these colonies, but he believed that the painter would never be cut, and that all would pull together.

Sir Charles Lucas, in replying, said he accepted the invitation for that evening for two reasons. The first, a personal one, was that the British public did not lavish so many marks of affection on gentlemen in public offices that they could afford to refuse a compliment when it came their way. The West Indies, in dispensing with his services, had given him a character, and he, in dissolving the partnership, entirely declined to part with the goodwill. His second reason was that he wished to take the opportunity of speaking of the great services rendered by Sir Nevile Lubbock to the West Indies. It was a great advantage to those colonies in the troublous times through which they had passed to have as their spokesman in this country a man whose character was as high as his courage, and who had been always above and beyond the slightest suspicion of self-seeking. He (Sir Charles) had served under three Secretaries of State, one of whom was Mr. Chamberlain. David Wells, the great American economist, had written that wherever

* For this account of the speeches we are indebted to several newspapers which took reports, and especially to the West India Committee's *Circular*.

England had gone, two blades of grass grew where one had grown before, and whenever he thought of those words he thought also of Mr. Chamberlain. Whatever Mr. Chamberlain touched he made it live and grow. When he lost Mr. Chamberlain, he was delighted to find that his new master was his old friend, whom to know was to love, Mr. Alfred Lyttelton, and after him he again fell into the hands of another old friend, the present Secretary of State, to whom he owed so much. The past few years had been years of incidents and of accidents for the West Indies. They had had three bad hurricanes, a volcanic eruption in St. Vincent, an earthquake in Jamaica, and three bad riots at least, a sugar crisis, and a sugar grant. He would only trouble them with two of the many impressions which these years had left on him. The first was this: During the years he was connected with the West Indies he was brought face to face with men who were fighting a life-and-death battle against adverse conditions, and it went to his soul how easy it was for a man sitting in an office and drawing a fixed salary to write well-turned homilies to men whose livelihood and fortunes were at stake; and he learnt then that the more humane a Government office was the more it would win and keep the confidence of those outside. Another impression he gained was how much the West Indies had lost by not being one. We were always being taught by people who thought they knew better than others what were the causes which lost us the United States. As he read history, those causes were largely twofold. The first was that there were no steamers or telegraphs. Edmund Burke had laughed down the idea of an Imperial Parliament, but if he had been living now he would have revised what he then said. The relations then between the colonies and the Mother country were dependent on the wind and tide. But we had lost them, too, he thought, because we had been dealing with thirteen colonies instead of one. If they dealt with a larger community it was apt to breed larger men with wider views. They all wished the West Indies were one, but they all knew how great were the difficulties. In the absence of that, value must be attached to the agencies which held them together, such as the Imperial Department of Agriculture, the West India Committee, and the West Indian Club, which extended a hospitable welcome to all. The 18th century saw their greatness, the 19th century their distress, and the 20th, he hoped, would see their regeneration. There were many signs which made them hopeful, Whatever might be the outcome of the sugar negotiations, he would never believe that a system radically vicious and hopelessly wrong, when once it had been rudely shaken, would ever recover its former strength. Looking back on the past and looking forward to the future, he would be a fool who would attempt to set limits to the productiveness of Nature and ingenuity of man. Who could doubt, for instance, that when the Panama Canal was completed it would bring added wealth and

importance to the West Indies? Whatever the future might have in store, good fortune was the due of the West Indies; indeed, it was long overdue.

Amongst subsequent speakers, was Lord Strathcona, who said that a change had now come over the conduct of Colonial affairs. That very year they had had a Conference—it was now an Imperial Conference and not a Colonial one. The change showed a broadening of views. He believed that it would bring the Mother-country and the Colonies into closer community and add to the importance of the race. What was certain was that the self-governing colonies were Imperialistic to the backbone.

A QUARTZ COMPENSATING POLARISCOPE WITH ADJUSTABLE SENSIBILITY.

By Frederick Bates.

All of the polarizing systems so far devised for quartz wedge polariscopes have been defective for one or two reasons; either the sensibility of the instrument cannot be varied or it can be used only with monochromatic light. The system, which has given the best results and is in general use at the present time, is the so-called half-shade. It introduces into polarimetry the photometric principle, inasmuch as the angular position of the analysing nicol is determined by bringing the two halves of the field of the instrument to a condition of uniform illumination. In any half-shade system the light from the polarizer is plain polarized in two planes which make an angle α called the polarization angle, with each other. All the light illuminating either half of the field is thus polarized in one of these planes, and when a setting is made the polarization plane of the analyser makes approximately a right angle with the bisector of α. Upon the magnitude of α depends the accuracy with which settings can be made; the sensibility for any given light source being an inverse function of that magnitude. Hence it is exceedingly desirable that a polarizing system permit α to be varied as the observer may desire.

A monochromatic light-source of sufficient intensity and suitable for the average work for which quartz compensating polariscopes are used is yet to be obtained. In order to obviate this difficulty the rotation produced by the substance being examined is compensated as completely as possible by the use of oppositely rotating quartz. Since the polarization planes of the different wave lengths are thus returned to their original positions, white light can be used. This, however, makes it necessary for the polarizing system and the analyser to be mounted so as to be immovable. The polarization plane of the analyser then makes approximately a right angle with the bisector of α.

The systems most used in polariscopes are the Laurent, the Jellet, and the Lippich. In the former a thin plate of quartz, cut parallel to the optic axis, covers one-half the field of the polarizing nicol. In order that the two rays of the doubly refracting quartz may combine to give plain polarized light in the analyser they must have an optical difference of path equal to $\lambda/_2$. Thus the thickness of the quartz must be such as to make it a half-wave plate, and its use is then limited to a light source giving only that particular wave-length. The advantage of this system is its adjustable sensibility, α being twice the angle between the optic axis of the plate and the plane perpendicular to the principal section of the polarizer, can be readily varied by rotating the polarizer. The Jellet system consists of a twin nicol so made that the principal sections form the angle α. Since the different sections are cemented together the sensibility cannot be varied. It can, however, be used with white light. In the Lippich system α is formed by two beams of plain polarized

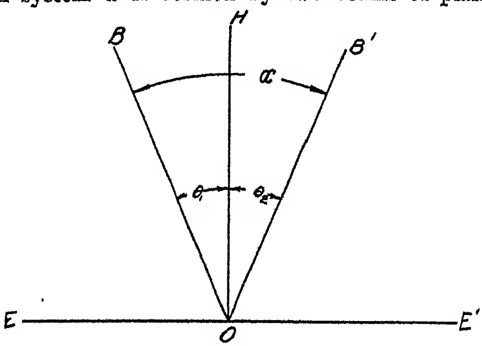

FIG. 1.

light which comes from two separate nicols, one of which covers but one-half the aperture of the larger nicol. By rotating either of these nicols α can be varied as in the Laurent polarizing system.

In designing quartz compensating polariscopes the best results so far have been obtained by using a Lippich polarizing system and a white light source. The greatest weakness has been the lack of an adjustable sensibility. Only one value of α can be used, and it must necessarily be large enough to give sufficient light to read, for example, the darkest coloured raw sugar solutions. When polarizing substances having a small coefficient of light absorption, as the better grade of sugars, and the observer has more light than he needs, he still has available only that sensibility which corresponds to that value of α which gives sufficient light to polarize substances with a relatively large coefficient of absorption, such as very dark raw sugars. If then it were possible to retain the white light source, and at the same time have α adjustable a distinct advance in polariscope construction would be made.

Let OB and OB′, Fig. 1, be the traces of the polarization planes of the large and small nicols of a half-shade polarizing system. If the intensities of the light in OB and OB′ are equal. the polarization plane EE′ of the analysing nicol will be at right angles with OH, the bisector of α. If α be increased or diminished by displacing OB′ about the point O, it is evident that when a match is again obtained EE′ will have suffered one half the angular displacement through which OB has been rotated. However, in the Lippich system, since the smaller nicol covers one half the field of the larger, we do not have the two beams OB and OB′ of equal intensity. If the intensity of OB is A, the intensity of OB is A $\cos^2\alpha$. When EE′ is set for a match the angle between EE′ and OH is therefore never 90° for any value of α except O.

The condition for equal illumination with a half-shade system is:—

$$A_1 \mathrm{Sin}^2\theta_1 - A_2 \mathrm{Sin}^2\theta_2 = O. \qquad (1)$$

where A_1 and A_2 are the intensities of their respective halves of the field, and θ_1 and θ_2 are the angles HOB and HOB′.

Let $\theta_1 = \phi \pm \delta$

$\theta_2 = \phi \mp \delta$

Equation (1) becomes

$$A_1 \mathrm{Sin}^2(\phi \pm \delta) = A_2 \mathrm{Sin}^2(\phi \mp \delta) \qquad (2)$$

From (2) we obtain

$$\tan\delta = \pm\frac{\sqrt{K}-1}{\sqrt{K}+1}\tan\delta$$

or since

$$\theta_1 + \theta_2 = \alpha$$

$$\tan\delta = \pm\frac{\sqrt{K}-1}{\sqrt{K}+2}\tan\frac{\alpha}{2} \qquad (2)$$

where $K = \frac{A_2}{A_1}$ and δ is the angular difference, for any value of α, between the positions of EE′ for a match with $A_2 = A_1$, and when $A_2 = A_1\cos^2\alpha$. It is thus evident if α be varied by rotating OB′ about the point O, that to obtain a match EE′ must be rotated in the same direction as OB′, and by an amount such that the normal to EE′ always makes an angle α with OH the bisector of BOB′.

It would seem a difficult task to build a mechanism that would maintain EE′ in the proper position to satisfy the theoretical value of α given by (3). If such a mechanism were obtained the observer could detect no difference in the intensities of the two halves of the field, once the instrument was adjusted, no matter what value α might be given. The limits of accuracy in ordinary polarimetry are such as to make such a mechanism unnecessary. If EE′ should always be maintained at right angles to OH, the fixed zero point of the instrument would be in error by the amount δ for any value of α, provided the instrument had been previously adjusted for $\alpha = 0$. If

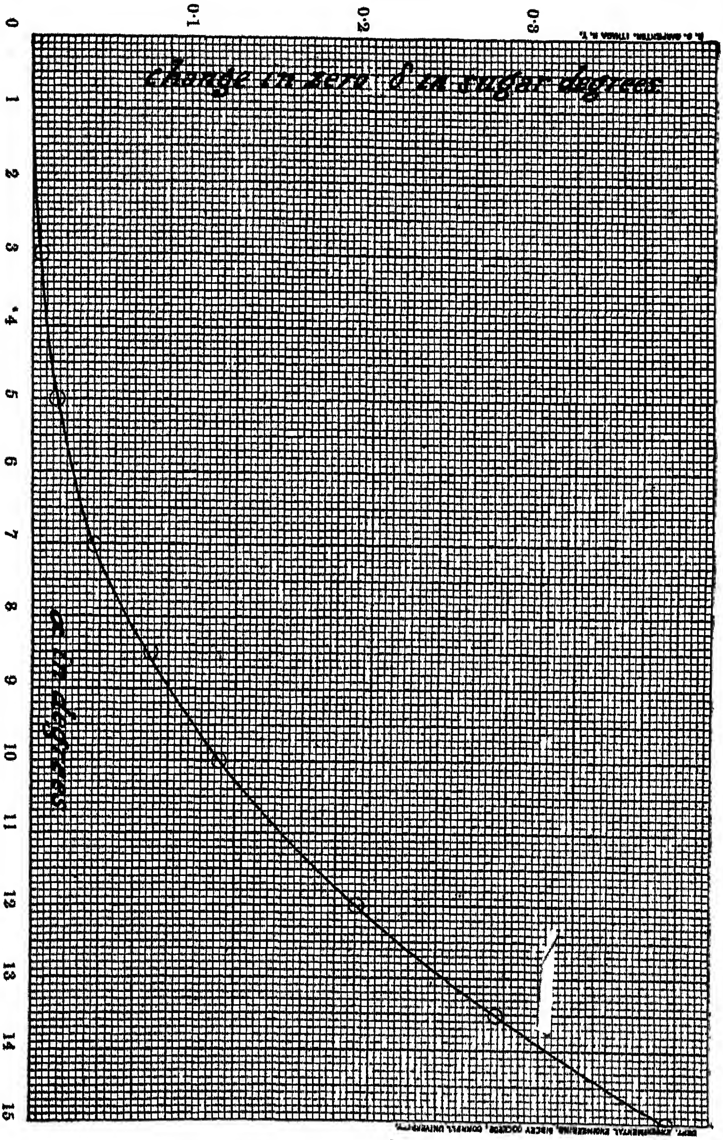
change in zero δ in sugar degrees
α in degrees
0
0·1
0·2
0·3
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIG. 2.

the zero of the instrument be adjusted to read correctly for any particular value of α and then α be changed, the zero will be in error by the difference between the values of δ corresponding to the two values of α. The curve in Fig. 2 shows the value of δ, obtained by solving (3), corresponding to any value of α between 0° and 15°. From this curve it is at once evident that with an instrument equipped with a Lippich polarizing system, in adjustment for a polarization angle $\alpha = 10°$, α may be varied between the limits of 4° and 12·4° without introducing an error due to a change in the zero point greater than 0·1° S (sugar degrees), provided EE′ be constantly maintained at right angles to OH. If the zero point be adjusted for $\alpha = 8·5°$, α may be varied from 0° to 11·5° with a maximum error of 0·1° S; or from 5·6° to 10·3° with a maximum error of 0·05° S.

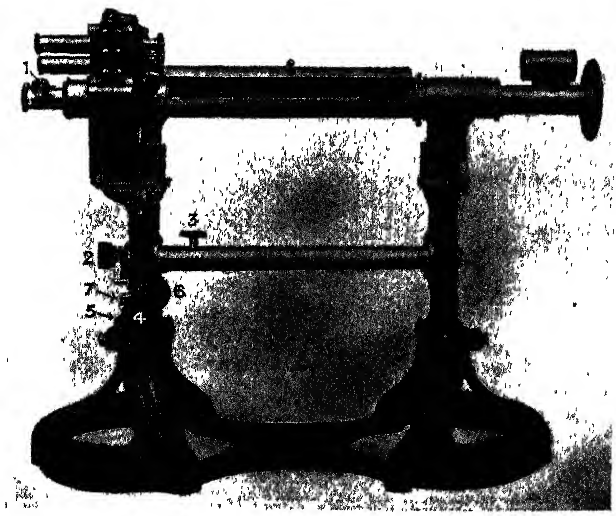

Fig. 3.

The instrument shown in Fig. 3 was built* for the U.S.A. Bureau of Standards to fulfil the theoretical conditions mentioned above. It is a double quartz wedge compensation instrument with a Lippich polarizing system. The analysing nicol and the large nicol of the polarizing system are mounted in bearings, and are joined by gears with a connecting rod. The milled head of this rod is shown half way between the base of the instrument and the observing telescope. When the milled head is rotated the two nicols are rotated, and the

* The builders were Messrs. Josef and Jan Fric, Kral. Vinohrady 233, Prag, Austria.

design of the gears is such that the analysing nicol always receives one-half the angular displacement of the large nicol of the polarizing system. Around the milled head is a circular scale which shows the polarizing angle for any position of the nicols. The milled heads on the right and left hand sides of the instrument drive the quartz wedges of the compensator, and their position is such as to permit the arm of the observer to rest free from strain while making a setting. The wedges can instantly be clamped rigid for any part of the scale. The scales on the quartz wedges are of the type used on regular Fric saccharimeters. Being of glass, and read by transmitted light, the scale divisions are exceedingly clear, and there is no black dividing line between a scale and its vernier. In all research work where small temperature corrections are to be made it is necessary to know accurately the temperature of the quartz wedges. Polariscope builders seem to have ignored this fact. A thermometer (10° C.—40° C., 1/5 degrees), with a horizontal scale, and with its bulb between the quartz wedges, has accordingly been mounted in a brass case on top of the metal box containing the compensator.

For all ordinary sugar testing, where the temperature of the room changes slowly, the reading of this thermometer is practically the temperature of the room. The observer is thus able to take the temperature with the same facility that he reads the scale on his wedge since the thermometer scale is in a similar position and is illuminated by the same light source. The base of the instrument has been made exceptionally heavy, and is mounted on rubber tips, to insure against accidental change of position relative to the light source.

The improvements are equally advantageous for all uses to which the polariscope may be put. However, it is in the testing of sugars the new instrument should find its broadest application. With the instrument in adjustment for a polarization angle of 10° the observer can instantaneously adjust the sensibility so as to have sufficient light to polarize the darkest sugars; or he can with equal facility have an instrument far more sensitive than any ordinary saccharimeter. In measuring rotations with the greatest possible accuracy, or when it is desired to make the settings with the least possible strain on the eye, the observer has only to change the polarization angle until he has just sufficient light to bring the two halves of the field to the same intensity. He then has for his eye an instrument so adjusted as to give the maximum sensibility for making the setting, no matter what the character of the substance whose rotation is being measured. With the instrument adjusted for $\alpha = 0$ the observer soon learns the exact change in the zero point of the scale for all values of α, and instantly makes the slight correction mentally for each value of α used. He is thus able to determine the polarization of the better grades of sugar to an accuracy of $\pm$ ·01° S.

OFFICIAL CORRESPONDENCE RELATING TO THE ADDITIONAL ACT TO THE BRUSSELS SUGAR CONVENTION.

The official correspondence relating to the Additional Act to the Brussels Sugar Convention has just been issued as a Parliamentary Paper (Cd. 3780).

It will be remembered that the Act was signed on August 28th last by all the Powers concerned after a month of negotiation, of which this Paper gives the principal correspondence.

The first letter is from Sir H. Bergne to Sir Edward Grey, wherein mention is made of the last sitting of the Permanent Commission, at which a very general desire was expressed that arrangements should, if possible, be made which would permit Great Britain to remain a party to the Sugar Convention. After a somewhat prolonged discussion the Draft of an Additional Act was drawn up to be submitted to the respective Governments. This Draft, as translated, was as follows:—

The Governments of Germany, Austria-Hungary, Belgium, France, Great Britain, Italy, the Grand Duchy of Luxemburg, the Netherlands, Peru, Sweden, and Switzerland, having settled to conclude an Additional Act to the Convention of the 5th March, 1902, relative to Sugar Regulations, the Undersigned, duly authorized for this purpose, have agreed upon the following:—

ARTICLE I.

The Contracting States undertake to maintain the Convention of the 5th March, 1902, in force for a fresh period of five years, commencing on the 1st September, 1908.

It shall, however, be possible for any one of the Contracting States to withdraw from the Convention after the 1st September, 1911, provided one year's notice has been given, if the Permanent Commission, at the last meeting held before the 1st September, 1910, have decided by a majority of votes that circumstances warrant such power being granted to the Contracting States.

For the rest, the provisions of Article X. of the above-mentioned Convention of the 5th March, 1902, concerning the denunciation and continued operation of the Convention will still be applicable.

ARTICLE II.

Notwithstanding Article I., Great Britain will be relieved, after the 1st September, 1908, from the obligation contained in Article IV. of the Convention.

After the same date the Contracting States may demand that, in order to enjoy the benefit of the Convention, sugar refined in the United Kingdom and thence exported to their territories shall be accompanied by a certificate stating that none of this sugar comes from a country recognized by the Permanent Commission as granting bounties for the production or exportation of sugar.

ARTICLE III.

The present Additional Act will be ratified, and the ratifications thereof will be deposited at Brussels, at the Ministry for Foreign Affairs, as soon as possible, and in any case before the 1st February, 1908.

It will only become legally binding if it is ratified at least by all the Contracting States which are not affected by the special provision contained in Article VI. of the Convention. In the event of one or more of the said States not having deposited their ratifications by the proper time, the Belgian Government will, in the course of the month which follows the 1st February, 1908, call upon the States which have already ratified to give a decision as regards the putting into force among themselves alone of the present Additional Act.

The States which have not ratified before the 1st February, 1908, shall be considered as having denounced the Convention in time for it to cease to have effect as far as they are concerned after the first of the following September, unless a contrary decision shall have been come to, at the request of the Parties interested, by a majority of the States called upon to deliberate, as arranged for in the preceding paragraph.

In faith whereof, the respective Plenipotentiaries have signed the present Additional Act.

Done at Brussels, the , in a single copy, of which a certified copy will be given to each of the Signatory Governments.

Protocol of Signature.

At the moment of proceeding to the signature of the Additional Act of the Convention respecting Sugar Regulations, concluded on this day's date, between the Governments of Germany, Austria, Hungary, Belgium, France, Great Britain, Italy, the Grand Duchy of Luxemburg, the Netherlands, Peru, Sweden, and Switzerland, the undersigned, duly authorised for this purpose, have agreed upon the following :—

SOLE ARTICLE.

It is understood that if the ratifications which are necessary before the above-mentioned Additional Act can be made valid in accordance with Article III. have not been obtained by the 1st March, 1908, His Britannic Majesty's Government will be able to denounce the Convention on this date as from the 1st September, 1908, without entering into the question whether they have previously ratified the aforesaid Additional Act or not.

The present Protocol of Signature, which will be ratified at the same time as the Additional Act concluded under this day's date, shall be of equal force and validity. In faith whereof the Undersigned have drawn up the present Protocol.

Done at Brussels the , in a single copy, of which a certified copy will be given to each of the Signatory Governments.

The Certificate for Refined Sugar alluded to in Article II. was approved of by the Commission in the following form :—

Certificate for Refined Sugar exported to a Contracting State.

I, Collector of Customs at the port of hereby certify that the sugar of which particulars are stated in the schedule annexed hereto and destined for exportation to was refined in the United Kingdom from raw sugar originating exclusively in countries

which have not been declared by the Permanent Commission established by the International Sugar Convention to give bounties on the production or exportation of sugar.

In sending out the Draft to the respective Governments, the Belgian Government added a Note stating briefly the extent of the arrangements proposed, and the reasons which had seemed to make those arrangements necessary. As regards Article I. of the Draft the Note states :—

ARTICLE I.

It has seemed opportune to affirm, first of all, the intention of the Contracting States to uphold the Convention of 1902, and to formulate in Article II. the only modification which the Additional Act introduces into it.

Article I. equally regulates the duration of the Arrangement. In this respect the Permanent Commission had to consider three alternatives :—

The first, which was immediately set aside as not affording a sufficient guarantee for the security and stability of the international sugar trade, made the Arrangement denounceable from year to year, provided twelve months' notice were given ;

The second assigned to the said Arrangement a compulsory duration of five years, in accordance with the stipulations made in 1902 ;

The third alternative, while fixing a normal duration of five years, authorized an earlier denunciation if exceptional circumstances should render such desirable.

It was observed that this last combination had the merit of affording guarantees of stability to trade, without making it more difficult to deal with exceptional and unexpected situations which the bringing into force of the Arrangement would create.

The Permanent Commission signified its preference for this more comprehensive alternative. It then remained to specify the cases in which the power of earlier denunciation could be made use of.

Suggestions were made on this subject, but it soon became evident that it would be very difficult to hit upon absolutely exact formulæ and dangerous to restrict in advance cases in which recourse to such denunciation might be necessary, since no one could foresee the practical consequences of the new arrangements made by the Convention.

In these circumstances an agreement was reached in regard to the text of paragraph 2 of Article I., which allows each of the Contracting States to withdraw from the Convention after the 1st September, 1911, provided one year's notice has been given, if, at the last meeting held before the 1st September, 1910, the Permanent Commission have decided, by a majority of votes, that the circumstances warrant that such power should be given to the Contracting States.

The Permanent Commission, in which are included representatives of all the States concerned, are the body best qualified to appreciate the measures which might be appropriate in the circumstances, and, on the other hand, by making the power of denunciation dependent upon a vote of the majority, recourse to the power of earlier denunciation without proper justification is prevented.

As regards Paragraph 3 which describes the situation in which those States would find themselves which had not ratified before the 1st of February, 1908, the Note points out that two contingencies have to be faced :—

Either *(a.)* All the States not mentioned in Article VI. of the Convention ratify before the 1st February, 1908; in that case the Additional Act is legally applied, and the States mentioned in Article VI. which have not ratified by the proper time shall retain the right of demanding to adhere to the Arrangement subsequently; or

(b.) One or more of the States not mentioned in Article VI. do not ratify in time; in that case the other States which have ratified, without distinction as to whether they are, or are not, mentioned in Article VI., shall meet and deliberate as to whether they shall form themselves into a further union of more restricted sphere. By the terms of paragraph 3 of Article III. they can, at the request of parties interested, consider it, and on what conditions the States (either mentioned or not in Article VI.) which up to that time have not ratified, may still remain members of the International Union.

There appears to be no reason for refusing this permission, since time for reflection is given them with the object of allowing them to form, if possible, an independent union. On the other hand, the proposed combination would counter-balance the excluding measure which threatens States, who, by reason of circumstances over which they had no control, could not deposit their ratifications before the 1st February, 1908.

The protocol of signature which accompanies the Draft Additional Act was not inserted into the Draft itself, because it merely constituted a precautionary measure which would only be called into operation if the Additional Act were not to come into force.

All the States belonging to the International Union save three promptly assented to the Additional Act being signed. The three exceptions were Germany, Italy, and Holland, who raised some preliminary objections. The German Government sent the following reply :—

The Imperial Government are sincerely desirous of securing the continuance of the Brussels Sugar Convention, of the satisfactory results of which they are aware. When, in consequence of the intervention of Great Britain, one of the most important fundamental provisions of the Convention was to undergo a radical alteration, those Germans whose interests were affected declared that it was difficult to reconcile the British proposals with the interests of our own industry. In these circumstances, the Imperial Government endeavoured to discover a means whereby the British proposals might be accepted and the Sugar Convention so maintained, without excessive prejudice to the economic conditions of Germany. For these reasons the Permanent Delegate received instructions to indicate at the recent session of the Permanent Commission the points to the gaining of which our industry attached a special value, and the regulation of which in consequence might bring about an understanding between the adverse interests, in a manner favourable to the aims of the Convention.

As the proposals of the Permanent Commission only partly take into consideration the proposals of our manufacturers, the Imperial Government

are obliged again to consult the parties interested in regard to their attitude towards the Brussels draft Additional Act.

The Permanent Delegate of the Imperial Government reported that, according to the statements of the Chairman at the sittings of the Commission, it was necessary to take into consideration the possibility of the adhesion of Russia to the Sugar Convention, and that a declaration on this subject by the Russian Government was shortly expected. As the above-mentioned note does not allude to this point, and as, on the other hand, the attitude of Russia towards the Brussels Convention is of very great, if not final, importance, from the point of view of the attitude of Germans concerned, towards the proposed Additional Act, it is partly desirable, in view of the negotiations with parties interested, that the Imperial Government should be informed as soon as possible as to the eventful adhesion of Russia.

In the event of Russia being inclined to adhere in principle to the Convention, but not being able to accept without alteration the stipulations of the Convention of the 5th March, 1902, the Imperial Government are of opinion that it would not be possible to avoid holding a Conference, which might take place towards the end of October or beginning of November next, to consider the question of the adhesion of Russia; this Conference could also examine the proposals made by the Permanent Commission at Brussels.

If, in these circumstances, the Imperial Government cannot express a definite opinion, they nevertheless attach importance to declaring expressly that they have no intention of refusing in principle to consider the arrangements which have been drafted at Brussels.

They cannot, however, refrain from raising certain formal objections to the proposed text, objections which the contents of the explanatory note cannot remove.

According to paragraph 3 of Article III. of the Additional Act, the States which might perhaps ratify later would agree to deprive those States which had not ratified of all the rights which, according to the Brussels Convention, belong to them so long as the Convention has not been denounced in conformity with the stipulations of Article X. A similar arrangement would be ineffectual as regards States which had not ratified. The former Convention would therefore remain in force without alteration, and consequently without relieving Great Britain from the obligation set forth in Article IV., and could only be abandoned without giving rise to doubts by a denunciation, itself conditional, formulated on the 1st September next. The signature of the Additional Act before the 1st September would alter nothing, because it has only a formal value, whilst the ratification alone is binding upon the Governments, and this can only take place after the adoption of the Act by the Parliament.

In these objections lies another reason why it seems opportune, in the event of the question of the adhesion of Russia leading to the summoning of a Conference, to invite this latter Power also to consider the material modifications to be introduced into the Convention in the sense desired by Great Britain.

The Dutch Government had no serious objection to make; they however thought that the power of denouncing the Sugar Convention

before 1st September, 1910 (referred to in the second paragraph of Article I.) should not belong to the Permanent Commission, but that it was desirable to give this power unreservedly to each one of the Contracting States.

The Italian Government desired to reserve for themselves till January 31st, 1908, the full and entire power of retiring from the Union if they saw fit and for this purpose suggested an alteration in the protocol of signature which would allow them to be considered to have retired from the Union on 1st September, 1908, in the event of their not having ratified the Additional Act by January 31st next. In short they wished it clearly to be understood that they made their ratification dependent upon the results of the further examination of the question.

In replying to the German objection, the Belgian Government wrote:—

1. As regards the first reason, that, in suggesting to the Governments interested to proceed to the signature of the Additional Act before the 1st September, 1907, the principal object of the Permanent Commission was to prevent the denunciation of the Convention by the British Government on that date, but the Commission had thought that the Governments would only consider themselves definitely bound when they had ratified the arrangement. If the Imperial German Government shared these views it would be permissible for them to make the ratification of the arrangement contingent upon a favourable result from the renewed consultation to which they intend to have recourse.

2. The proposals of the Imperial Russian Government in regard to their entry into the International Sugar Union are at present known to the German Government.

3. The Russian Government could only adhere to the new Convention, in the form in which it will be applied after the 1st September, 1908.

It would therefore seem desirable that the Governments which at present belong to the International Union should agree among themselves as to the basis of the new arrangement before examining the conditions upon which the adhesion of other States will be made to depend. For the rest it seems that it would be advantageous to wait, before submitting the question of the adhesion of Russia to a diplomatic Conference, until previous exchange of views between the allied Governments on the subject of the basis of negotiations shall have demonstrated the expediency of this meeting.

4. By paragraph 3 of Article III. the Government would declare that if they do not ratify the Additional Act before the 1st February, 1908, they will consider themselves, and will be considered, as having denounced the Convention in time for it to cease to affect them after the 1st of the following September. In the opinion of the members of the Permanent Commission, this Declaration, made and signed by the Governments interested before the 1st September, 1907, bore all the characteristics of a normal conditional denunciation. The possible omission to ratify the Act which contained the Declaration by one or other of the Signatory Powers had not appeared necessarily to influence the useful effect of the said Declaration, since the

denunciation, which falls within the province of executive power, becomes executory automatically without ratification.

Nothing would stand in the way, however, if the Imperial Government retained any doubts respecting the procedure suggested for the completion of the Protocol of signature in such a way as to prevent all misunderstanding, or even for the submission for the signature of the Contracting States of a third document, which should be neither approved by the Parliaments nor even ratified, and by which the said States would declare the Convention of the 5th March, 1902, to be conditionally denounced after the 1st September, 1907, in the event of their not ratifying the new Arrangement.

While drawing the attention of the Imperial German Government to the foregoing considerations, the Government of the King beg to lay stress upon the fact that the adhesion which they would be willing to give upon the conditions above indicated to the Additional Act of the Brussels Convention would only constitute a definite engagement if the said Act was ratified within the dates laid down.

But this adhesion, joined to that of all the other States interested, would testify to the general wish to prolong the international understanding and would prevent the isolated denunciation of the British Government, which would probably produce in industrial circles an impression all the more marked because the deliberations of the Permanent Commission had given grounds to hope for an early Agreement.

If at the time fixed for the ratifications to be deposited, that is to say the 1st February, 1908, it was stated that it had not been possible to conclude the Agreement upon the basis authorised by the Additional Act, there would still be sufficient time, before 1st September, 1908, to submit to the Diplomatic Conference, to which the note of the Imperial Government alludes, the questions to be settled in view of the continuation of the union.

As the result of the several observations offered, certain amendments to the original Draft were prepared for consideration. In the 1st paragraph of Article I. "three years" was substituted for "five years"; the second paragraph was omitted and paragraph 3 was left untouched. Great Britain expressed her willingness to accept the Draft as amended, but ultimately the Belgian Government found itself able to withdraw it and have the original Draft signed by all parties. In deciding to subscribe to the new Act, Germany made the following communication to the Belgian Chargé d'Affaires:—

From declarations made by the Imperial Russian Government, the Imperial German Government conclude that the former will not be able to adhere to the Brussels Sugar Convention of the 5th March, 1902, without some alterations in its stipulations. It will therefore depend upon the result of the further negotiations which are going to be conducted with the Russian Government, if and on what conditions the adhesion of Russia to the Convention in question will take place. Consequently the Imperial Government are not yet in a position to know exactly to what extent the adoption of the proposal of the British Government will be likely to affect the interests of the German sugar industry.

In these circumstances, without assuming a definite attitude in regard to the inferences to be drawn from the remarks contained in the aforesaid note, and with the view of doing the utmost, for their part, for the maintenance of the Brussels Sugar Convention, the Imperial Government have decided to state that they agree to sign the Additional Act and the Protocol of Signature which relates to it before the 1st September next; the Imperial Government must, however, stipulate particularly that their decision in regard to ratification may be made dependent upon the fact of Russia having adhered to the Brussels Sugar Convention at the proper time, and on acceptable conditions.

EXPERIMENTAL WORK WITH SUGAR CANES IN JAMAICA.

In the annual report of the Board of Agriculture of Jamaica on the experimental work carried out in Kingston during the year ending March 31st last, the following is the report supplied by Mr. Cousins, the Island Agricultural Chemist, on the work done with sugar canes.

SUGAR CANES AT THE EXPERIMENTAL STATION.

"The eight acres of canes at Hope which are grown for the Sugar Experiment Station are under my direction and the arrangement has worked satisfactorily.

"Of the 101 varieties of canes grown at the Gardens which were tested at the Laboratory in 1902, 46 were abandoned, and 12 new Seedlings from Barbados and Demerara were added. These 67 varieties were tested as plants in 1905 and again as ratoons in 1906. As a result of this trial 27 more varieties were discarded, and the selected 40 together with 18 new acquisitions were planted out in 100 and 30 hole plots and cut in February last. We have now discarded 22 more varieties, and of the 131 canes tested we now retain 34 as worthy of further trial. These consist of 7 named varieties (of which 5 are retained for purposes of comparison only) 16 Demerara Seedlings and 11 Barbados Seedlings.

JAMAICA SEEDLING CANES.

"None of the seedlings raised in 1901 and 1902 proved to be of value. In 1903 operations were started on a larger scale and of 500 seedlings 40 were selected for trial. These have now been grown as plants and ratoons and again as first ratoons and some of the seedlings outclass any other canes at present growing at Hope. Of the 1904 seedlings 15 have shown themselves superior to the White Transparent, up to 82 per cent., at the first trial, and are being tested on a larger scale, while the ratooning powers are also under observation.

"While the 1904 seedlings were raised from seed from Demerara canes, those of 1905 are presumptive hybrids, of certain Barbados varieties (B. 208, B. 156, B. 306, B. 347) with the White Transparent

obtained from the experiment announced in my first report on Seedling Canes in 1902.

"As was anticipated these seedlings do not show an increase in sucrose content over the White Transparent, but are marked by a greater vigour of growth and should yield a larger return of sugar per acre.

"This work has been carried out under the supervision of Mr. P. W. Murray, Superintendent of Field Experiments, whose zeal has enabled a larger increase in the number of sugar cane experiments to be carried out with improved accuracy.

"The Foreman and Superintendent at Hope have assisted us in every way, and it is satisfactory to find this work progressing so favourably. An increase of two acres to the cane land, making 10 acres in all, has now been sanctioned.

"During the past year 103,965 cane-tops (mostly of B. 208) have been sent out to Estates. Some very encouraging results from the growth of B. 208 have been obtained, while B. 147 has proved a splendid cane for heavy soil in Trelawny under dry conditions."

SUGAR CANE VARIETIES IN BRITISH GUIANA.

The recent controversy regarding the identity of seedling canes in Demerara having attracted considerable attention, it may be worth while giving our readers a list of the different varieties grown on the plantations in British Guiana. We therefore reproduce below the official amended returns of the results of experiments with varieties of sugar canes carried out during the year ending December, 1906, on those Plantations which have supplied the Board of Agriculture with the necessary data.

Table I. shows the various plantations in the colony from which returns giving the yields in tons of commercial sugar per acre for at least three varieties of sugar canes have been received. In this table the varieties of which reports have been supplied from any plantation are indicated by the signs 1, 2, and —, the first showing the kind of cane reported as having given the highest average return of commercial sugar per acre, the second showing that which gave the next best average return of commercial sugar per acre, whilst the third indicates other varieties cultivated.

The table is summarized to show the number of plantations which supplied the returns for each variety of cane, and the number of plantations on which any variety was reported as having given the highest or second best yields of sugar per acre.

Table II. shows the number of plantations which supplied reports on varieties of cane, the total acreage of each variety reported on, its total yield of commercial sugar, and the mean and true average yields of the varieties in tons of commercial sugar per acre.

Table III. gives each of the results reported with the variety B 208 in which the yield in tons of commercial sugar per acre was recorded.

Table IV. shows the mean yields in tons of commercial sugar per acre reported in the crop-years 1904, 1905, and 1906, together with the means of the yields over the three crops.

TABLE I.

	Bourbon.	White Transparent.	B 109.	B 147.	B 208.	Sealy.	D 74.	D 78.	D 95.	D 109.	D 115.	D 117.	D 145.	D 625.
BERBICE PLANTATIONS.														
Springlands	..	1	..	..	..	..	..	..	..	2	..	..	..	..
Albion	..	..	..	..	..	..	..	..	2	..	..	..	..	1
Rose Hall	..	2	..	1	..	..	..	..	..	..	..	..	..	..
Providence	1	..	..	..	..	..	..	..	..	2	..	..	..	..
DEMERARA PLANTATIONS.														
Hope	..	..	..	..	..	..	..	..	..	2	..	..	..	1
Cove and John	..	2	..	..	..	..	..	..	..	..	..	..	..	1
Enmore	2	..	..	..	..	1	..	..	..	..	..	..	..	..
Nonpareil	..	..	..	..	..	..	..	..	..	1	..	..	..	2
Lusignan	..	..	..	..	..	..	..	..	..	..	..	..	1	2
Mon Repos	..	..	..	..	..	..	..	..	..	2	..	..	..	1
La Bonne Intention	..	..	..	..	..	..	..	..	..	..	..	..	2	1
Vryheid's Lust	..	..	..	..	..	..	..	..	..	2	..	..	..	1
Ogle	..	..	..	..	..	..	..	..	..	2	..	..	..	1
Houston	..	..	..	..	..	..	..	..	..	..	..	..	1	2
Nismes	..	..	..	1	..	..	..	..	..	2	..	..	..	..
Wales	..	..	..	..	..	..	1	..	..	..	..	..	2	..
Windsor Forest	..	..	..	..	..	..	..	..	..	2	..	..	1	..
Cornelia Ida	..	..	..	..	..	..	..	..	..	..	..	..	1	2
Leonora	1	..	..	2	..	..	..	..	..	..	..	..	..	..
Uitvlugt	2	..	..	..	..	..	..	..	..	..	..	..	..	..
De Kinderen	..	..	..	..	1	..	..	..	..	2	..	..	..	..
ESSEQUEBO PLANTATIONS.														
Golden Fleece	..	..	..	..	..	..	2	..	..	..	..	..	1	..
Taymouth Manor	..	..	..	1	2	..	..	..	..	..	..	..	..	..
Anna Regina	..	..	..	1	..	..	..	..	..	..	..	..	2	..
Hampton Court	2		..	..	..	..	..	..	..	..	..	..	..	1
SUMMARY.														
Number of Plantations	17	15	6	15	6	7	5	4	3	24	4	3	16	20
Number of highest Yields	2	1	..	4	1	1	1	..	..	1	..	..	5	9
Number of second Yields	3	2	..	1	1	..	1	1	1	9	..	..	3	4

TABLE II.

Name or Number of Variety.	Number of Plantations which reported.	Average reported on.	Total yield of Commercial Sugar.	Yields of Commercial Sugar in tons.	
			Tons.	Means.	Averages.
D 145..	15	449	952	2·06	2·12
D 625	21	1,921	3,656	1·86	1·90
Green Transparent ..	3	72	124	1·85	1·72
B 208..	6	159	314	1·84	1·97
Bourbon..	15	14,955	27,049	1·71	1·81
D 109..	27	5,037	8,224	1·70	1·63
B 147	15	994	1,719	1·67	1·73
D 74	5	95	194	1·62	2·05
B 109	6	89	144	1·59	1·62
D 115..	3	18	31	1·58	1·82
D 78	3	46	62	1·46	1·35
Sealy	6	139	218	1·45	1·57
D 95	3	32	43	1·37	1·36
White Transparent..	14	1,124	1,780	1·30	1·58
D 117..	3	55	66	1·22	1·20

TABLE III.

Name of Plantation.	Acres reaped.	Tons of Commercial Sugar made	Yields of Commercial Sugar per acre.
De Kinderen	7	16·8	2·40
Taymouth Manor	2	4·0	2·
Rose Hall	17	25·8	1·52
Wales	115	285·*	2·47*
Golden Fleece	3	4·6	1·53
Albion..	15	21·	1·40
Totals, Means, and Averages ..	159	314·6	Mean 1·84 Average 1·97

* Tons of 2,000 lbs.

TABLE IV.

Name or Number of Variety.	Mean Yields in tons of Commercial Sugar per acre			
	1904.	1905.	1906.	1904–1906.
D 625	1·94	2·20	1·86	2·10
D 145	1·74	1·92	2·06	1·91
D 115	1·79	1·91	1·58	1·76
D 95	1·71	2·17	1·37	1·75
B 109	1·88	1·74	1·59	1·74
B 208	1·07	2·18	1·84	1·70
Bourbon	1·64	1·61	1·71	1·65
B 147	1·50	1·77	1·67	1·65
D 74	1·42	1·89	1·62	1·65
Sealy	1·61	1·72	1·45	1·59
D 117	1·76	1·51	1·22	1·50
D 78	1·14	1·62	1·46	1·41
White Transparent	1·26	1·41	1·30	1·32

ON THE TREATMENT OF SACCHARINE JUICES AND MOLASSES WITH CALCIUM AND ALUMINIUM SILICATES, THE NATURE AND PROPERTIES OF THE RESULTING SYRUPS, AND THE SOLUBILITY OF THE CONTAINED SUGARS.

By Dr. H. Claassen.

(Continued from page 546.)

Estimating the Viscosity of the Molasses Solutions.

In my study of the viscosity of sugar solutions in 1898, I then indicated that lime salts increased the viscosity much more than a like amount of potash salts. Thus the time required by 100 ccm. of a sugar solution, saturated at 30° to flow from a viscosimeter with an exit 3 mm. in dia. and at a temperature of 30° was:—

	Seconds.
Sugar solution alone	164
,, ,, with 10% potash chloride	134
,, ,, ,, 10% sodium ,, ..	298
,, ,, ,, 10% calcium ,, ...	737
,, ,, ,, 5% potash acetate ..	206
,, ,, ,, 5% sodium ,, ...	278
,, ,, ,, 5% calcium ,, ..	333

It was therefore only to be expected that the viscosity of the molasses filtered over *permutit* with an increased lime-content, would be much higher than that of the normal molasses.

As was indicated in the work just referred to, estimations of viscosity can only be comparative. The solutions to be compared must be dealt with in the same viscosimeter under similar conditions of temperature and concentration. In order that the molasses might be tested in as concentrated a condition as possible, we employed a viscosimeter having a platinum outlet 30 mm. in length and 8·5 mm. in diameter.

Both samples of molasses (*i.e.*, that filtered through paper and that through *permutit*), were reduced to a water-content of exactly 18%, and tested at temperatures of 45° and 70°, these being the conditions that were likewise adopted in the subsequent crystallization experiments.

100 ccm. of molasses of 18% water-content, and at a temperature of 45° required:—

	Seconds.
For the normal molasses	51
For the permutit-treated molasses	180
At a temperature of 70°:—	
For the normal molasses	10
For the permutit-filtered molasses	20

The viscosity of the molasses filtered through *permutit* and containing much lime salt is thus very much greater than that of a normal molasses of equal water-content and temperature; but with a rise in temperature this difference is reduced in a proportionately higher degree than is the case with the normal molasses. Thus while the time occupied by the first molasses at 45° is about three times as great as the time required by the normal molasses, at a temperature of 70° it is only twice as much.

Besides that, the viscosity of the molasses filtered through *permutit* is apparent to the eye. Such a molasses concentrated to 20% water-content forms at ordinary temperatures a tenacious, non-flowing, mass, whereas the normal molasses of the same water-content and at similar temperatures flows readily.

The conclusion of Kohler referred to above that juices or syrups filtered over silicates should have a lower viscosity is thus clearly erroneous; and his mistake was evidently due to the fact that he did not estimate the viscosity directly but had merely observed that the crystallization commenced in a syrup of low viscosity. This last observation is quite correct, as will be shown further on; it has however nothing to do with the calculation of the viscosities but only with the solubility of the sugar.

It is therefore well demonstrated that all experiments dealing with viscosity which are not strictly comparative are not only valueless but are sure to give rise to further errors. I can only impress on chemists the importance of never ascertaining the viscosity by the appearance alone but by experiments similar to the one just described.

Estimation of the Solubility and Crystallizability of Sugars in Molasses Syrups.

The question of the solubility of sugars in solutions containing lime salts has only been studied by Professor Herzfeld, as far as I know, and then only with artificially prepared solutions. He found that calcium chloride, nitric acid, and acetate of lime diminished the solubility of the sugars. At a temperature of 30°, 219 parts of sugar were dissolved in 100 parts of water to form a saturated solution; but on the addition of 3·6% $CaCl_2$ only 193 parts; with 3·6% calcium acetate 202 parts; and with 5·4% calcium acetate 192 parts were held in solution.

Neither have experiments been undertaken to ascertain the crystallizability of sugars in syrups containing lime salts. It is only known that the purity of molasses containing much lime, such for example, as are met with in Russian factories, is at least lower than the purity of molasses that contain little or no lime salts, and consequently that the sugar crystallizes out of the former juices in somewhat larger quantities.

It is often admitted that there is a relation between the solubility of the sugars and the amount of the sugar crystallizing out. That is

of course only true to a certain extent. Under identical concentration more sugar will naturally crystallize out of an impure sugar solution in which the sugar is less soluble than out of a solution that contains more sugar dissolved per 100 parts of water. But the crystallization in the latter case can be increased by further heating. Hence the degree of exhaustion of the syrup depends, not on the solubility of sugar but on the molasses-forming properties of the non-sugars, that is the property of the non-sugar to prevent the sugar from crystallizing when a certain concentration is reached whereby an apparent increase in non-sugars results.

This molasses-forming property of different non-sugars has so far been little investigated. The experiments on solubility and crystallization carried out by Professor Herzfeld throw no light on these points, inasmuch as they only dealt with sugar solutions of a high purity. The tendency of non-sugars to retard crystallization is based partly on chemical and partly on physical influences; chief among the latter being the influence of *viscosity* in the case of strongly concentrated syrups, since the viscosity increases greatly with concentration of a syrup. If therefore, the presence of non-sugars diminishes the solubility of a sugar, crystallization of the latter will proceed until the concentration becomes sufficiently reduced, and we thus get the advantage of a more viscous syrup at the concentration most suited for crystallization as compared with those in which the non-sugar has raised the solubility of the sugar. This action of the viscosity can be shown clearly by means of the following experiments which were designed to study the action of lime on the crystallization of syrups and molasses under favourable circumstances.

To carry out the crystallization we employed an apparatus similar to that used by Herzfeld, the syrups and molasses being subjected to crystallization in motion in metal flasks at a temperature which did not fluctuate more than two degrees either way. Each flask received 500g. of molasses or syrups of the composition referred to on a previous page, and to assist crystallization 100 gr. of well-sifted crystal sugar was added to each. One flask was filled with the most concentrated sample and the remainder were diluted with water in gradually increasing proportions, so that the most diluted ones remained unsaturated under the prevailing temperature, and some sugar was allowed to dissolve. In this way not only was the lowest purity to be expected in the most strongly or most suitably concentrated syrups, but also the solubility could be observed in syrups of different purities approximating to that of ordinary molasses.

Two sets of experiments were undertaken, one at a temperature of 45°, the other at 70°. In each experiment both normal molasses and molasses filtered through *permutit* were similarly crystallized. The stronger concentrated molasses were stirred for a short while at a higher temperature, thus, for example, one having a normal crystal-

lization temperature of 45° was raised to 60° or 65°. Then as soon as it was cooled down to 45° again, it was mixed with the less concentrated syrups and the whole crystallized for 96 hours at a constant temperature.

After this the flasks were taken out, opened, and their contents passed through a fine sieve which retained the sugar crystals, whereby cooling of the flasks in water of 45° (or 70°) was avoided. The syrups thus filtered off were poured into well-stoppered bottles and were then ready for testing. From the sugar and water contents ascertained one calculated the proportion of sugar dissolved in 100 parts of water and also the coefficient of saturation, *i.e.*, the figure representing the number of times more sugar that can be dissolved in the syrup per 100 parts water than in pure saturated sugar solutions of the same temperature. The polarization was calculated as sugar inasmuch as the difference between direct and indirect polarization was very small.

Crystallization Experiment I.

Temperature, 45°; Period, 96 hours.

Normal Molasses.

Purity 61·6. Lime content: 1·7 on 100 dry substance.

	1	2	3	4	5	6	7
Polarization ..	51·8	51·8	49·8	49·6	49·8	49·8	50·0
Water	21·7	21·1	18·4	17·1	15·9	15·6	14·1
Purity	66·2	65·7	61·0	59·8	59·2	59·0	58·2
Water: Pol....	239	245	271	290	313	319	355
Coefficient of Saturation..	0·96	0·99	1·09	1·17	1·22	1·29	1·43

Molasses containing Lime Salts.

Purity 62·3. Lime content: 4·86 parts per 100 dry substance.

	1	2	3	4	5	6	7	8
Polarization ..	49·4	48·0	46·7	47·5	48·5	50·8	51·2	51·8
Water	23·6	22·7	20·8	20·2	19·2	16·2	15·5	14·5
Purity	64·6	62·1	58·9	59·5	60·0	60·6	60·6	60·6
Water: Pol....	210	211	225	235	253	319	330	357
Coefficient of Saturation .	0·84	0·85	0·91	0·95	1·02	1·27	1·33	1·44

Crystallization Experiment II.

Temperature 70°; Duration, 96 hours.

Normal Molasses.

Purity 61·6. Lime content: 1·7 per 100 dry substance.

Polarization ..	54·6	54·6	53·4	52·9	52·6	52·8
Water	15·1	14·5	14·0	12·7	12·3	11·6
Purity	64·3	63·9	62·1	60·6	60·0	59·7
Water: Pol.....	362	377	381	417	428	455
Coefficient of Saturation ..	1·15	1·18	1·19	1·30	1·34	1·42

Molasses containing Lime Salts.

Purity 62·5. Lime content: 1·7 on 100 dry substance.

Polarization	51·0	49·0	48·6	49·4
Water	17·9	16·7	16·3	14·6
Purity	62·1	58·8	58·1	57·8
Water: Polarization	285	293	298	338
Coefficient of Saturation	0·89	0·92	0·93	1·06

It is obvious from these experiments that the solubility of sugar in the syrups containing lime salts is lower than in that of the original molasses. But one can only take for comparison those syrups which were not supersaturated by excessive heating, hence only those in which the viscosity did not prove a hindrance to crystallization.

EXPERIMENT I.

Normal Molasses.			Molasses containing Lime Salts.		
Quotient.	Parts Sugar lost per 100 parts water.	Coefficient of Super-saturation.	Quotient.	Parts Sugar lost per 100 parts water.	Coefficient of Super-saturation.
65·7	245	0·99	64·6	210	0·85
61·0	271	1·09	62·1	211	0·85
59·8	290	1·17	—	—	—
59·2	313	1·22	58·9	225	0·91

EXPERIMENT II.

62·1	381	1·19	62·1	285	0·89
60·0	428	1·34	58·8	293	0·92
—	—	—	57·8	338	1·06

At a crystallization temperature of 45° and in a lime salt syrup, having a purity of 65-59, there are 35 to 88 parts less sugar dissolved than in a normal molasses. At 70° the difference is much greater, being at 62 purity as much as 100, and with lower purities still higher.

The amount of sugar that has crystallized out is, however, not increased altogether in relation to the reduced solubility of the sugar. At the temperature of 45°, the lowest quotient that could be obtained by the molasses containing lime salts was 58·9, but with normal molasses 58·2. Here the influence of the viscosity is clearly shown. Whereas in the case of the normal molasses the quotient falls consistently with stronger concentration, in that of the molasses containing lime salts the crystallization ceases at a certain stage of concentration. In the former case again the solubility of the sugars becomes much greater with a fall in the purity of the molasses (the coefficient of saturation rises from 1·17 for a quotient of 59·8 to 1·43 for a quotient of 58·2), but the crystallization still continues in spite of the correspondingly increasing concentration. In consequence, the solubility

of the sugars in the lime salt molasses apparently decreases considerably, yet crystallization ceases entirely as soon as more than about 230 to 235 parts sugar are dissolved in 100 parts water, while the coefficient of saturation exceeds 1. Indeed, with a proportion of 100 water to 250 sugar, the crystallizing out of the sugar becomes plainly less. The reason for this phenomenon can only be the obviously greater viscosity of the molasses containing lime-salts, which increases in much greater ratio with the concentration than is the case with normal molasses.

That it is only the viscosity that prevents the lime salt molasses from crystallizing out at 45° can furthermore be shown by the fact that at a crystallization temperature of 70° these molasses can crystallize out much further than at 45°, and also than the normal molasses. At 70° they can crystallize out to 57·8 purity with a coefficient of saturation of only 1·06, whereas the normal molasses with a coefficient of 1·42 can only be brought to 59·7 purity. Since the viscosity of the two molasses varies far less at this high temperature the better action of the lower solubility of the sugar in the lime-salt molasses points to the conclusion that its viscosity is less than that of the normal molasses which has to be concentrated still further to induce crystallization.

From these data it follows that all juices filtered through calcium or aluminium silicates, or otherwise containing lime salts, must be treated quite differently from normal syrups to bring about crystallization.

Syrups containing lime salts must be crystallized out at as high a temperature as possible, and under a much higher water content. The lower the temperature at which crystallization is completed, the more carefully must the correct concentration be maintained. If we allow lime salt syrups to crystallize out at the same concentration as normal syrups, we obtain a final molasses which is badly crystallized, tenacious, and will not centrifugal properly.

It is no doubt of some interest to point out that in these properties of lime salt molasses we have the explanation of the more favourable results recorded in the Russian factories with Grosse's system of crystallization than has been the case in Germany. Russian factories have almost always much lime salts in their juices, and consequently the crystallization in the Grosse apparatus with its prevailing high temperature yields better results than the usual apparatus worked at a low temperature in which the syrups of German factories are as a rule better and more easily crystallized out.

Since the purity of the juices is somewhat increased by filtration over *permutit* and with a careful and judicious crystallization, yields a somewhat smaller quotient of molasses, the output of sugar can be

increased slightly by working with *permutit*. If we suppose that 2% molasses on beets is obtained, the purity of which is increased by filtration through silicates by 0·8%, and which can be brought by judicious crystallization to a final purity about 1 degree lower, then there are obtained per 100 parts molasses about 4·5 to 5 more parts of after-product sugar; or per 100 kg. of roots 0·1 kg. of after-product corresponding to a gain of 1 pfennig (0·1d.) per 100 kg. of roots, supposing the after-product sugar is reckoned at 15 pfennig and the molasses at 5 pfennig. per kg. Any attempts to calculate the gain in potash salts from the revivification must fail; it is however for the present doubtful whether this treatment with lye yields any profit. The small gain in sugar output would not cover the cost of filtration, all the less, since it is produced by a system of extra heating and special crystallizing of the juices and syrups as would not prove feasible in practice.

The conclusions to be drawn from the above experiments are as follows:—

By filtering juices and molasses through calcium and aluminium silicates in the prescribed manner about half the alkali is replaced by an equivalent amount of lime.

Following on this displacing of the alkalies, particularly potash, with the lime, the equivalent quantity of which weighs less, the weight of the ash constituents is reduced and the quotient of purity is correspondingly increased.

The treatment with silicates has no other action than the replacing of the alkali with lime, and particularly is there no reduction in the amount of organic non-sugar.

The syrups rich in lime salts, obtained by filtration of molass through silicates, have a much greater viscosity than the origin unlimed molasses, especially at low temperatures.

The boiling of juices and syrups which are rich in lime sa much aggravated by strong frothing, and the heating ceas proportionately higher water content. These juices also sh greater degree a disinclination to boil properly (Schwerko

In the syrups containing lime salts the solubility of appreciably lower than in the original unlimed molas and while in the case of the latter the solubility in with a rising temperature like in pure sugar solution in the coefficient of solubility with the temperatu lime salt syrups is only observed in a minor degree

As a consequence of the smaller solubility of salt syrups the water content during boiling a

to be higher, and a strong supersaturation at low temperatures has specially to be avoided since the inevitable rise in the viscosity would hinder the crystallization.

Since the solubility of sugars in lime salt syrups only increases very slightly with a rise in temperature as compared with pure solutions, and their viscosity decreases much more strongly with a rising temperature than with common solutions, these lime salt syrups crystallize best and most quickly at a high temperature.—(Translated from *Vereinszeitschrift.*)

THE GROWTH OF THE BEET SUGAR INDUSTRY IN THE UNITED STATES.

The *American Sugar Industry* recently reproduced in its columns the report of an official of the Department of Agriculture, Washington, on the progress of the beet sugar industry in the United States during 1906, as showing in the most striking manner the growth of this industry within the last few years. From it we take the following particulars which will be found of general interest.

The number of acres planted by the various States in 1906 was 395,615, of which Colorado headed the list with 114,190, and Michigan came second with 99,665 acres. Not more than five per cent. of this had to be abandoned as unfit to harvest.

The following are some statistics of factory and farm results for [illegible]e past six years 1901-06, which give a good idea of the progress [illegible]de.

Year.	Factories in operation.	Area harvested.	Average yield of beets per acre. (b)	Beets worked.
		Acres.	Tons. (a)	Tons. (a)
[illegible]	63	376,074	11·26	4,236,112
[illegible]	52	307,364	8·67	2,665,913
[illegible]	48	197,784	10·47	2,071,539
[illegible]	49	242,576	8·56	2,076,494
[illegible]	41	(e) 216,400	8·76	1,805,812
[illegible] ..	36	175,083	9·63	1,685,689
[illegible]6..	..	277,841	9·13	2,079,089

Year	Sugar Manufactured.		Estimated average extraction of sugar.	Average sugar in beets	Average purity coefficient of beets.	Average length of campaign.
.	Pounds.	Tons. (a)	Per cent.	Per cent.		Days.
1906 ..	967,224,000	483,612	11·42	14·9	82·2	105
1905 ..	625,841,228	312,921	11·74	15·3	83·0	77
1904 .	484,226,430	242,113	11·69	15·3	83·1	78
1903 ..	481,209,087	240,604	11·59	(c) 15·1	(d)	75
1902 ..	436,811,685	218,406	11·52	(f) 14·6	(g) 83·3	94
1901 ..	369,211,733	184,606	10·95	14·8	82·2	88
Averages 1901–1906	479,460,033	239,730	11·53	15·0	82·3	82

(a) Short tons—2000 pounds.

(b) The average yield of beets per acre is found by dividing the total beets worked by the total acreage; the average extraction, by dividing the total sugar produced by the total beets worked; the averages for sugar contents, purity coefficients, and length of campaigns, by adding the figures for each factory and dividing by the number of factories in operation.

(c) This percentage represents data from only 14 out of 49 factories operating in 1903, no reports having been received from the others. The percentages of extraction reported by the other factories, however, indicate that this figure is probably too low rather than too high.

(d) Coefficients of purity were, unfortunately, not included in the report for 1903.

(e) In 1902 the statistics of "factory and farm results" contain data on acreage harvested for only 27 out of 41 factories in operation, the total for these being 166,127 acres. The total acreage for the year given here—216,400—is the result of a carefully made estimate based on the total tonnage reported for the 14 factories not reporting acreage and the weighted average yield per acre of the 27 which reported acreage. The belief that this estimate is conservative is confirmed by comparison with the figure given by Willett and Gray for acreage in 1902.

(f) Represents 19 out of 41 factories in operation 1902.

(g) Represents only 15 out of 41 factories in operation in 1902.

The year 1906 has proved a record one, the beet industry h made enormous strides. The increase as compared with the p five years amounts to no less than 65 per cent. in acreage, w tonnage of beets worked and the yield of sugar has been n doubled.

The development of the industry in the far West wh are grown mainly by irrigation has been far m extensive than in the middle and eastern States whe grown by rainfall alone. If the former be taken to in Colorado, Oregon, Washington, Idaho, Utah, Mont they have 57% of the factories, 61% of the acreag beets, and nearly 71% of the sugar product.

It is therefore apparent that the Western St practised are on the whole better adapted f

than are the States further east where dependence for moisture is made on rainfall only. The eastern States can however point to a lower cost of producing beets and to better markets and higher prices.

MECHANICAL TILLAGE.

Interesting and important developments are in progress in Antigua in connection with the introduction of implements to supplement hand work in tilling and weeding.

Two complete sets of Fowler's steam ploughs and accessories were introduced on two separate groups of estates in 1906. Experience had been made of implements of this class from the early sixties, and their use was continued up to about 1890; for some years, however, steam ploughs have not been in use in the island. The function of these ploughs is to enable cultivation to be carried on at the most favourable periods of the year, and to permit of deeper tillage than is possible with ploughs drawn by animals.

The re-introduction of steam ploughs is, in itself, of interest, but the development to which attention is now more particularly drawn is in the direction of using light mule-drawn implements for weeding and surface tillage in place of hoes and forks.

Late in 1906, Messrs. Henckell, Du Buisson & Co. introduced a number of American implements, and, under the direction of one of their managers who had visited Louisiana, assisted by an expert from that State, commenced the cultivation of a considerable area of land or canes on lines involving the minimum of hand labour: the work .s now been in progress a sufficiently long time to admit of ntion being drawn to the results already achieved.

de land was ploughed in some cases by steam, in other cases by ploughs, after which it was thrown into ridges by means of rawn implements. For this purpose several implements are ely used. These may be either a double mould-board wheels with adjustable mould boards, or a single mould-h, or a disc turn-plough, as may be most convenient.

o made is kept in tilth and weeded by means of disc ich form the ridges into good shape while stirring the ng weeds; or a "walking cultivator," drawn by two used. The hollows between the ridges, known as eded and deepened by a light double mould-board "middle burster." The weeding of the middles by means of the "walking cultivator" which gangs, and shovel points, enabling it to in furrows.

Thus by means of implements the land is ploughed, ridged or banked, cultivated and weeded up to the time the canes are to be planted without recourse to hand labour.

In order that the implements should pass freely over the land, the system of draining requires consideration. Deep open drains are dug at suitable distances according to the nature of the land; these may be from 30 feet to 100 feet apart; they run parallel with the ridges and thus are not crossed by the implements*; shallow drains known as "quarter-drains" cross the ridges or furrows at right angles, and deliver any surplus water into the main drains. This is the point where local opinion feared the system would break down, for it was anticipated that the "quarter-drains" would prove insufficient. It is satisfactory, however, to note that they appear to answer their purpose admirably, and doubts on this point are rapidly disappearing. Any small quantity of mould thrown by the implements into the "quarter-drains" is removed by small pony plough or by hand. This calls for little effort.

Contrary to the practice common in the island, where the canes are planted in the furrow, the canes in the new system have been planted on the ridge. To effect this a slight furrow is opened on the top of the ridge by means of one of the implements, such as the "middle-burster" or the pony plough, and pieces of cane are laid flat in the furrow so formed. These are covered either by the light pony plough, the "walking cultivator," or by the disc cultivator. A light rolling or trampling suffices to press the mould closely around the cane. The young canes thus spring from the top of the low ridge, and the animals drawing the implements walk in the furrows or "middles."

The cane being planted, the whole surface of the field is kept gent stirred by suitable implements, of which there is a somewhat la choice. The "walking cultivator," drawn by two mules, ma made to stir the surface either of the ridge or furrow, or th cultivator may be employed, or the orchard harrow may be u the furrows. Several of these implements are adjustable so t will turn the mould in either direction as desired, will for or flatten one down.

By means of the implements the soil may be kep stirred and weeded, so that weeds are effectually kept d few which make their appearance on the top of the rid young cane shoots. Most of these can be covere thrown up by the implements, but here and there it to have recourse to the hoe. The implements w between the canes until the latter have grown 3 feet.

* These drains are made by ha

Beyond the effect of weeding, a most important result follows from the ability to stir the whole surface of the soil to a depth of 2 or 3 inches. This forms what is known as a dust mulch, and constitutes a most important means of conserving soil moisture. That this effect does result was demonstrated a short time ago when, at the end of a long, dry spell, samples of soil were taken from two adjacent spots, both under young canes, one of which had been worked under the old system, and the other under the new; the samples were taken from (*a*) the surface, (*b*) 5 inches deep, and (*c*) 15 inches deep. The surface soil under the new system contained 2 per cent. less moisture than that under the old, but at 5 inches deep there was 5 per cent. more moisture, and at 15 inches over 5½ per cent. more. The significance of this will be seen when it is remembered that 5 per cent. of moisture is approximately equal to 1 inch of rain in a foot of soil. In other words, at the end of the dry period the soil cultivated under the new system had an advantage over that treated under the old, equal to an inch of rain, and moreover, had had the continual benefit of the additional moisture throughout the whole period.

While this development has been in progress important changes have taken place in connection with the labour supply. Where formerly labour was abundant, and it was sometimes difficult to find work for labourers, now with the expansion of agricultural effort in the direction of cotton growing, and of the cultivation of canes by the peasantry for sale to the factories, together with the depletion of the labour supply by emigration, there is considerable difficulty in finding sufficient hands. A method which permits of the cultivation of the fields, and the raising of a crop by the use of implements proves most acceptable, and, apart from its other advantages, will ommend itself to planters; and already there is evidence that the stem will soon be quite widely adopted.—(*Agricultural News.*)

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failure of the Knickerbocker Company of New York has affected two Guantanamo (Cuba) centrals which were by the Company. As a consequence it is feared that the t of the two sugar estates will be greatly hindered.

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cohol as a motive power for automobiles is increasing he use of a mixture of alcohol and benzole is being buses of Paris with excellent results. As there is etrol famine in the not distant future, the chances nd still increasing motor industry will have to obtained from beets or potatoes for its ultimate

GERMANY.

Results of the Campaign of 1906-07.

The number of factories at work during the season which closed last August was 369, a reduction on the previous year of 7; and the present campaign promises a reduction by at least four more. In 1902-03 there were 393 at work.

The area planted with beets decreased from 471,472 hectares in 1905-06 to 444,183 hectares; this slight drop is accounted for by the reduction in the price of sugar during the last few months of 1906. but the figures for the last campaign are well above the average of the years 1896 to 1903.

The quantity of beets worked up amounted to 14,171,666 metric tons as compared with 15,773,477 tons in 1905-06. The yield per hectare was only 31·9 tons as compared with 33·4 the previous year, but was above the average of the past decade.

The sugar production in raw sugar value was as follows:—

1906-07. Metric tons.		19 5-06. Metric tons.		1904-05. Metric tons.
2,122,757	....	2,314,779	...	1,503,036

The yield obtained was 14·98 per cent. as compared with 14·71 per cent. in 1905-06.

CONSULAR REPORTS.

China.

The British Commercial Attaché at Pekin, writes:—

Ten years ago (1896) China's import of foreign sugar (
white, refined and candy) amounted to a total of 1,947,773 cw
1906 that quantity was more than quadrupled, the imp
7,792,550 cwts. of the value of £4,938,505. This immense i
made up of 3,204,140 cwts. brown, 2.157,310 cwts. whit
cwts. refined and 385,525 cwts. candy. There was in
import of 211,221 cwts. of sugar cane, but this no do
cane exported to Hong-Kong and afterwards re-impo
The increase in 1906 as compared with 1905 was 2,2
the import was 3,389,089 cwts. ahead of the avera
five years. Java now practically supplies the
direct to any extent but principally through Hon
sugar refineries melt the raw material and are c
1,000 tons of refined sugar per day. One of t

said to be the largest in the world under one roof, is the property of a British firm, and can, if called upon, produce over 700 tons of sugar per day of 24 hours. This refinery, which I recently visited, is fully equipped with the best up-to-date plant, labour-saving apparatus and machinery of every description, and is connected with its wharf by a double-track railway, enabling coal and raw sugar to be conveyed from lighter to mill and refined sugar from mill to lighter with the greatest promptitude and despatch. The Japanese refineries are endeavouring to obtain a share of this trade, but the Hong-Kong mills are holding their own against all competitors.

Swatow.—The export of sugar has always been the great stand-by of Swatow, but the cultivation of the cane in the neighbourhood of the port has fallen on evil times, due to the cheaper sugar from Java imported into China direct, or after treatment at the three refineries in Hong-Kong. Cheap Javanese labour (15 c. a day) has much to do with the inability of the Swatow sugar planter to conduct a profitable business. The area annually under cane in the neighbourhood of Swatow is placed at 25,000 acres, and the cane which some years ago realised 220 dollars per acre is now worth only 126 dollars, while the cost of sugar at the native sugar works runs from 7 dollars to 8 dollars 50 c. a picul (133⅓ lbs.), according to quality. Prices are now so low as to leave little or no margin of profit to the grower and boiler, and the export has fallen off some 50 per cent. in recent years. The export of brown and white sugar was 1,825,128 piculs in 1899, and 804,398 piculs in 1905.

Siam.

Bangkok.—The import of sugar in 1906 (£219,784) exceeds that of 1905 by £30,500, and is in excess of the five years' average by [illegible]9,230. The total for 1906 was received from the following [illegible]es:—

Place of Origin.	Value. £
Singapore	192,371
Hong-Kong	22,622
Java	3,334
Germany	1,239
Other countries	168
Total	219,784

Zanzibar.

[illegible] sugar into Zanzibar during 1906 was valued at [illegible]ed with £25,942 in 1905. It came from Germany, [illegible]gary, France and India.

PUBLICATIONS RECEIVED.

VADE-MECUM DU SUCRERIE. By Léon Pellet et Paul Mêtillon. Published at the Office of "La Sucrerie Indigène et Coloniale," 143, Boulevard Magenta, Paris, 1907. Price 6 francs.

This little work deals exclusively with such mathematical problems as arise in the sucrerie and laboratory. The author draws attention to the fact that as manufacturing operations tend to become more and more scientific, numerous practical questions arise which can only be solved mathematically. Some idea of the scope of the work may be gained from the following headings of chapters.

Definitions and general formulæ. Problems relating to mixtures and their practical applications. Problems relating to densities, purities, and saline-contents. Calculations connected with diffusion, milling, and drying. Liming, carbonatation, and sulphitation. Evaporation. Boiling to grain. Treatment of masse-cuites. Yield of masse-cuites. Filtration of molasses. Saccharimetry. Various formulæ and problems. Coloration of products. Calculations used in volumetric analysis. Tables.

Exhaustive as this list appears, we could have wished that still more had been included; such as, Calculation of inversion occurring at different stages of manufacture; Corrections of polarimetric readings for temperature; Calculation of weight of canes from composition of juice and megass.

Exception must be taken to the formulæ given for calculating the weight of juice yielded per 100 parts of milled cane, and which are a based on the fibre-content of the original and crushed canes. As th fibre-content cannot be determined with any degree of accuracy, s calculations are of little practical value. In actual practice, the is measured, its weight being determined from its density, and a much more reliable method than any formula based on fibre- With this exception, the book is an interesting and useful con to the technology of sugar manufacture, and can be without any extensive knowledge of the French langu every problem discussed is illustrated by a numerical ex

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A very tastefully prepared CATALOGUE of sugar lately issued by the Harvey Engineering Com Glasgow. The cover is a coloured one after painting by Mr. Robert Harvey (who is as accom as he is in his skilled profession) of a trop

large sheet of water in the central background. A preliminary chapter is devoted to a survey of the history of the sugar industry, to which we may have occasion to refer at some later date. The usual illustrations of machinery with descriptions appended are to be found on subsequent pages. These need no comment on our part, as the excellence of this firm's productions are well established; but we might refer to an interesting sketch of a sugar mill made in 1816 by James Cook, Engineer, of Glasgow, who originally founded the concern; also one of a marine engine as fitted to the steamboat "Albion" in 1815 and made in the same shops.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Chartered Patent Agent, 6, Lord Street, Liverpool; and 322, High Holborn, London.

ENGLISH.—Applications.

22256. R. Mitchell, Glasgow. *Improved roll for sugar cane mills.* 9th October, 1907.

22427. R. Mitchell, Glasgow. *Improvements in rolls for sugar cane mills.* 11th October, 1907.

22500. W. Mackie, Glasgow. *Improved figured roll for sugar cane mills.* 12th October, 1907.

24047. J. Mc.Neil, Glasgow. *Improvements in connection with ...ugar cane mills.* 31st October, 1907.

Abridgment.

...74. E. Shaw, London. *Improvements in apparatus suitable for ...illation of water, evaporation of syrups and like purposes.* 14th ...06. This invention relates to an apparatus for the distillation ... evaporation of syrups and like purposes, comprising ...etal sheets and interposed frames which are both formed ...s for the supply and removal of liquid to and from the ...stituted by the sheets and frames, suitable provision ...e for the supply of heating fluid and the withdrawal ...liquid.

GERMAN.—Abridgments.

... Karmin, of Vienna. *Continuously operated ...odic discharge effected by the lowering of its bottom.* ...n this centrifugal the discharge takes place by